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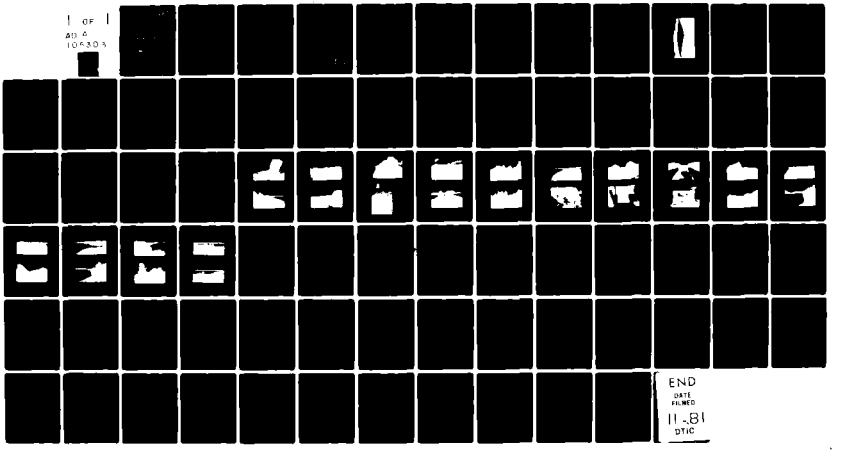

LEVEL II

GRAND-CHARITON BASIN

AD A105303

TRENTON LOWER LAKE DAM

GRUNDY COUNTY, MISSOURI

MO. 10366

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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TRENTON LOWER LAKE DAM
GRUNDY COUNTY, MISSOURI
MO 10366

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

PREPARED BY
HOSKINS-WESTERN-SONDEREGGER, INC.
CONSULTING ENGINEERS
LINCOLN, NEBRASKA

UNDER DIRECTION OF

ST. LOUIS DISTRICT, CORPS OF ENGINEERS

FOR

GOVERNOR OF MISSOURI

AUGUST, 1979

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 TUCKER BOULEVARD, NORTH
ST. LOUIS, MISSOURI 63101

REPLY TO ATTENTION OF

SUBJECT: Trenton Lower Lake Dam Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Trenton Lower Lake Dam. It was prepared under the National Program of Inspection of Non-Federal Dams.

SUBMITTED BY: SIGNED 26 MAR 1980
Chief, Engineering Division Date

APPROVED BY: SIGNED 26 MAR 1980
Colonel, CE, District Engineer Date

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM
ASSESSMENT SUMMARY

Name of Dam	Trenton Lower Lake Dam
State Located	Missouri
County Located	Grundy County
Stream	Tributary Muddy Creek
Date of Inspection	August 14, 1979

Trenton Lower Lake Dam was inspected by an interdisciplinary team of engineers from Hoskins-Western-Sonderegger, Inc. The purpose of the inspection was to make an assessment of the general conditions of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers and developed with the help of several Federal and State agencies, professional engineering organizations, and private engineers. Based on these guidelines, this dam is classified as an intermediate size dam with a high downstream hazard potential. Failure would threaten life and property. The estimated damage zone extends approximately one-half mile downstream of the dam. Within the damage zone are 20 or more trailer homes, 2 commercial buildings, Trenton airport with 2 buildings, Trenton Sewage Treatment Plant and an interchange connecting U.S. Highway 65 and Missouri Highway 6.

Our inspection and evaluation indicates that the spillway does not meet the criteria set forth in the recommended guidelines for an intermediate dam having a high hazard potential. The Probable Maximum Flood is the appropriate spillway design flood. The spillway will pass the 100-year flood (flood having a one percent chance of being exceeded in any year) without overtopping the dam. The spillway will pass 55% of the Probable Maximum Flood without overtopping the dam. The Probable Maximum Flood (PMF) is defined as the flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region.

It is recommended that the following be pursued on a high priority basis:

a. Increase the height of dam and/or the size of the spillway

in order to pass the Probable Maximum Flood without overtopping the dam.

b. Engineering studies should be performed to determine the cause, extent and potential effects on structural stability of the apparent slides in the downstream slopes of the dam, and to design protective measures if required.

c. Seepage and stability analyses comparable to the "Recommended Guidelines for Safety Inspection of Dams" should be performed for appropriate loading conditions, including seismic forces, and made a matter of record.

d. Additional studies should be made to determine the hydraulic characteristics of the spillway outlet structure and downstream channel and consequent effects on the integrity of the structure during high discharges through the spillway.

Maintenance has been lax as evidenced by the growth of trees on the slopes, rodent holes in the crest and the uncontrolled growth of sweet clover. Maintenance procedures concerned with the foregoing are recommended in Paragraph 7.2b of this report.

Rey S. Decker
E-3703

Garold Ulmer
E-4777

H. P. Hoskins
Harold P. Hoskins
Chairman of Board
Hoskins-Western-Sonderegger, Inc.
E-8696

PHOTO NO. 1 OVERVIEW

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
TRENTON LOWER LAKE DAM - MO 10366
GRUNDY COUNTY, MISSOURI

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, District Engineer directed that a safety inspection of Trenton Lower Lake Dam be made.

b. Purpose of Inspection. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria. Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams," Appendix D to "Report of the Chief of Engineers on the National Program of Inspection of Dams," dated May, 1975, and published by the Department of the Army, Office of the Chief of Engineers.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances.

(1) The dam is an earth fill approximately 5700 feet in length with a maximum height of about 20 feet. The dam is constructed on three sides of a square and impounds discharges from Trenton Upper Lake. The reservoir covers about 105 acres of nearly level bottomland adjacent to the east side of Muddy Creek on the eastern outskirts of Trenton, Missouri.

(2) The spillway consists of an ungated concrete chute with an 8 foot bottom width. The spillway is located in the west leg of the dam some 700 feet north of the

southwest corner of the dam.

(3) Pertinent physical data are given in paragraph 1.3 below.

b. Location. The dam is located in the central part of Grundy County, Missouri, as shown on Plate A-2. The dam is shown on Plate A-1 in the S½ of Section 15, T61N, R24W. The lake formed behind the dam is shown in the S½ of Section 15, T61N, R24W.

c. Size Classification. Criteria for determining the size classification of dams and impoundments are presented in the guidelines referenced in paragraph 1.1c above. Based on these criteria, this dam and impoundment is in the intermediate size category.

d. Hazard Classification. Guidelines for determining hazard classification are presented in the same guidelines as referenced in paragraph 1.1c above. Based on these guidelines, this dam is in the High Hazard Classification. The estimated damage zone extends about one-half mile downstream from the dam. Within the damage zone are 20 or more trailer homes, 2 commercial buildings, Trenton Airport with 2 buildings, Trenton Sewage Treatment Plant and an interchange connecting U.S. Highway 65 and Missouri Highway 6.

e. Ownership. The dam is owned by the White Estate, c/o Mr. Fred Layson, 806 E. 6th, Trenton, Missouri 64683.

f. Purpose of Dam. Recreation

g. Design and Construction History. It was reported by Mr. David Blackburn, Trenton City Administrator, that the dam was constructed in 1963 or 1964 by Fred Payne. No other information was available.

h. Normal Operating Procedure. There are no operating facilities for this dam.

1.3 PERTINENT DATA

a. Drainage Area. 713 acres (1.114 square miles) plus a 1250 acre feet reservoir (Upper Trenton) at the east edge of the lake.

b. Discharge at Damsite.

(1) All discharges at the damsite are through an uncontrolled, ungated concrete chute spillway.

(2) Estimated maximum flood at damsite -- unknown.

(3) The spillway capacity varies from 0 cfs at its crest elevation 753.4 feet to 142 cfs at elevation 756.8 feet (minimum top of dam).

(4) Total spillway capacity at the minimum top of dam is 142 cfs ±.

c. Elevations (feet above M.S.L.).

(1) Top of dam - varies from 756.8 (minimum) to 759.7 (maximum)
(2) Spillway crest - 753.4±
(3) Streambed at centerline - 740±
(4) Maximum tailwater - unknown

d. Reservoir. Length (feet) of maximum pool - 2,400±

e. Storage (Acre-feet).

(1) Top of dam - 1675±
(2) Spillway crest - 1314±

f. Reservoir Surface (Acres).

(1) Top of dam - 107±
(2) Spillway Crest - 105±

g. Dam.

(1) Type - earth fill
(2) Length - 5735 feet±
(3) Height - varies from 10 feet on the north and south legs to 20 feet on the west leg.
(4) Top width - 14 to 17 feet
(5) Side Slopes
  (a) Downstream - varies from 2 + H on 1V in upper section to 3 + H on 1V in lower (base) section
  (b) Upstream - varies from 1H on 1V to 1.8 H on 1V
(6) Zoning - unknown

(7) Impervious core - unknown
(8) Cutoff - unknown
(9) Grout curtain - unknown
(10) Wave protection - limestone riprap
(11) Internal drainage system - unknown

h. Diversion Channel and Regulating Tunnel. None

i. Spillway.

(a) Type - rectangular concrete chute with concrete drop outlet
(b) Crest (invert) elevation - 753.4 feet
Outlet - End of chute - 750.4 feet,
Bottom of outlet box - 743.2 feet
(c) Length - Control Section - 16 feet
Chute Section - 33 feet
(d) Upstream Channel - None, reservoir encroaches on spillway
(e) Downstream Channel - Natural earth, overgrown with trees and shrubs

j. Regulating Outlets. None

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

No design data were available for this dam.

2.2 CONSTRUCTION

No construction data were available. It was reported by Mr. Blackburn that the dam was constructed in 1963 or 1964 by Mr. Fred Payne.

2.3 OPERATION

No data were available on spillway operation.

2.4 EVALUATION

a. Availability. No data were available.

b. Adequacy. The field surveys and visual observations presented herein are considered adequate to support the conclusions of this report. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

c. Validity. Not applicable.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General. A visual inspection of the Trenton Lower Lake Dam was made on August 14, 1979. Engineers from Hoskins-Western-Sonderegger, Inc. Lincoln, Nebraska making the inspection were: R.S. Decker, Geotechnical, and Garold Ulmer, Hydrology. The owner was not represented during the inspection.

b. Dam.

1. Geology & Soils (Abutment & Embankment)
This dam is located in the alluvial flood plain of Muddy Creek abutting the bluff line of the adjacent loess-till uplands. The ends (north and south) tie into the till slopes of the upland area. The foundation soils under the embankment appear to be deep alluvial silts and clays (CL) derived from loess and till. The surface two feet of material in the embankment is silty clay (CL).

2. Upstream Slope. The upstream slope is well riprapped with durable limestone up to about spillway elevation of 754. The area above the riprap is vegetated with vetch and sweet clover. No significant erosion was noted on the upstream slope. A few willow trees are growing on the south and north legs of the dam. The area between Stations 12 + 50 to 13 + 20 ± (south leg) appears to be a slide or slump that has been repaired. No other cracks, slumps or other deformations were noted on the upstream slopes.

3. Crest - The profiles of the north and south legs of the dam are quite uneven, varying in elevations from 756.8 to 759.7. The profile of the west leg is quite uniform at about elevation 757.5 except for a high spot around the spillway (Sta. 27 + 00 to 28 + 00). The vegetative cover on the south leg (Sta. 0 + 00 - 19 + 00) is quite sparse and consists largely of weeds and vetch. Vegetation on the west leg is sparse (mostly weeds) from Sta. 19 + 00 to the spillway (Sta. 28 + 00). A fair stand of sweet clover covers the remainder of the west leg (to Sta. 40 + 00±). The north leg of the dam is covered with a very dense

growth of sweet closer and weeds (very difficult to walk through) which appears seldom, if ever, mowed. Typical clay drying cracks, 1/8 to 1/4 inches wide, were noted along the crest of most of the south and west legs of the dam. The areas between stations 10 + 15 to 11 + 00± and 12 + 50 to 13 + 20± (south leg) appear to have been repaired at some time. Such repair work could have been necessitated by slides or overtopping; however, there were no indications of recent overtopping. No other significant deformations were noted along the crest. Several rodent holes, up to 4 inches in diameter, were noted along the crest of the south leg (Sta. 2 + 00 to 18 + 00). A few ruts, 1 to 2 inches deep, were noted in the south and west legs of the dam.

4. Downstream Slope. The south leg is sparsely covered with weeds and some grass. Cover on the west leg is primarily weeds and sweet clover. Cover on the north leg consists of dense sweet clover and briars. A few willows and other trees, up to 6 inches in diameter, are growing on the downslopes of the south and north legs of the dam. The downstream slope of the west leg is pretty well covered with shrubs and willow, cottonwood and sycamore trees, up to 8 or 10 inches in diameter. Tree growth is especially heavy between stations 23 + 00 and 26 + 00.

   (a) South Leg: What appeared to be slump areas that had been repaired were observed downstream from about station 10 + 15 to 11 + 00 (see photo 6) and 12 + 50 to 13 + 20±. These apparent slump areas extend from the crest to about midway down the slope. A 0.5 to 0.75 inch wide crack running longitudinally from about station 16 + 80 to 17 + 10 was observed about midway down the slope. This area appeared to have slumped and been repaired. However, another crack was observed downstream from about station 18 + 00 to 19 + 00 that apparently resulted from poor backfilling of an electrical conduit trench (see photo 8) and the crack between 16 + 80 and 17 + 10 may have resulted from the same activity. No indication of seepage was noted in any of the apparent slump areas nor anywhere else along the downstream slope or toe of the south leg of the dam.

   (b) West Leg: No cracks were noted along the downstream slope of the west leg.

The possibility of a slide was noted between about station 25 + 50 to 26 + 00 where the lower (basal) half of the slope was much steeper (about 1H on 1V) than other sections of the slope. The only apparent reservoir seepage along the toe of the slope was observed at about station 28 + 50 to 28 + 75. No free water was observed but the area was wet and marshy. Most of the area downstream from (outside) the toe of the dam is wet and marshy. However, this area borders and is the overflow and backwater area for Muddy Creek. In fact, water is ponded just outside the toe of the dam in what appears to be old Muddy Creek channels between about stations 20 + 00 to 23 + 00 and 36 + 00 to 40 + 00 (see Photo 21). Considerable beaver activity was noted around the pond downstream from Sta. 36 + 00 to 40 + 00 but no rodent holes were observed on the dam.

(c) North Leg: No cracks or rodent holes were observed on the downslope of the north leg, however, the dense vegetative cover made it difficult for such observations. What appeared to be a slump area was observed between stations 53 + 00 to 53 + 50. The apparent slump or slide appeared as an obvious variation in the surface profile of the slope. It extends from the toe up to within 3 or 4 feet of the crest. No seepage was observed in the slide area but it was well vegetated with blue grass and water grasses which were foreign to the vegetative cover on the remainder of the slopes. Water grass was also observed growing 15 to 20 feet outside the toe of the dam from about Station 48 + 00 to the end of the dam (Sta. 57 + 34). However, this area serves as the outfall for surface drainage from the adjacent cultivated land on the north and from the housing development above and on the north end of the dam. A sewer line from the housing development (Upper Trenton Lake Homeowner Association) also follows along the downstream toe of the north leg of the dam. No other signs of seepage were noted on the downstream slope or along the toe of the dam.

5. Miscellaneous. Due to the poor vegetative cover and the presence of what appear to be old slide areas, it is doubtful that the south leg of the dam could withstand overtopping without causing serious damage.

c. Appurtenant Structures.

(1) The spillway consists of an ungated, rectangular concrete chute located at about station 26 + 92 through the west leg of the dam. The chute section is 33 feet in length with a vertical drop of 7.2 feet into a concrete box stilling basin. There are no blocks or other energy dissipators in the outlet box. The concrete structure appears to be in excellent condition. There appeared to be no apparent undercutting of the concrete stilling basin. Several large limestone blocks and boulders occupy the channel just downstream from the outlet box. Some erosion was noted in the earth channel downstream from the rock section but nothing significant.

(2) Drawdown Facilities. No drawdown facilities exist for this dam.

d. Reservoir Area. No significant erosion was noted around the reservoir. The riprapped embankment forms three sides of the lake and most of the remaining (east) side approaches the downstream toe of the Trenton Upper Lake Dam.

e. Downstream Channel. The natural channel downstream from the spillway is overgrown with brush and small trees, but it is doubtful that this growth would cause tailwater problems for the spillway.

3.2 EVALUATION

The stability of the downstream slope appears to be questionable in at least two sections of the south leg (Sta. 10 + 15 to 11 + 00 and 12 + 50 to 13 + 20±), one section of the west leg (Sta. 25 + 50 to 26 + 00) and one section of the north leg (Sta. 53 + 00 to 53 + 50) of the dam. The presence of rodent holes on the south embankment and the uncontrolled growth of trees, especially on the west leg of the dam, could lead to potential of failure of this embankment. The rank growth of sweet clover on the north and portions of the west legs should also be controlled.

Overtopping of this dam, especially the south leg, would probably cause serious damage to the dam and downstream areas.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

There are no controlled outlet works for this dam. The pool level is controlled by rainfall, infiltration, evaporation, and the capacity of the uncontrolled spillway.

4.2 MAINTENANCE OF DAM

Trees growing on the slopes, rodent holes on the crest, slump/slide areas, and the uncontrolled growth of sweet clover indicate the lack of any regular inspection or maintenance program for this dam.

4.3 MAINTENANCE OF OPERATING FACILITIES

No operating facilities exist at this dam.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

There is no warning system in effect for this dam.

4.5 EVALUATION

The lack of regular inspection and maintenance could lead to serious potential of failure of this structure.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design data. No design data were found for this dam.

b. Experience Data. The drainage area, reservoir surface area, and elevation-storage data were developed from the USGS Trenton, Missouri 15 minute topographic quadrangle map. The hydraulic computations for the spillway and dam overtopping discharge ratings were based on data collected in the field at the time of the field inspection.

c. Visual Observations.

(1) The Upper Trenton Dam spillway releases directly into the reservoir of the Lower Trenton Dam. The tailwater of the lower reservoir encroaches upon the downstream toe of the upper dam.

(2) Spillway appears to be in good condition. No trash or debris was found in the spillway entrance.

(3) There was some slight erosion in the earth channel downstream from the spillway. The channel was overgrown with weeds and small trees.

d. Overtopping Potential. The spillway is too small to pass the probable maximum flood without overtopping. The spillway will pass approximately 55% of the probable maximum flood without overtopping the dam. The spillway will pass the 100-year frequency flood without overtopping the dam. Overtopping of the dam would probably cause significant damage to the dam. The results of the routings through the dam are tabulated in regards to the following conditions:

Frequency	Inflow Discharge c.f.s.	Outflow Discharge c.f.s.	Maximum Pool Elevation	Freeboard Top of Dam Min. Elev. 756.8	Time Dam Overtopping Hr.
0.5 PMF	2200	90	755.9	+0.9	0
PMF	5100	4300	757.9	-1.1	8+
0.55 PMF	2500	140	756.8	0	0

According to the recommended guidelines from the Department of the Army, Office of the Chief of Engineers, this dam is classified as having a high hazard rating and an intermediate size. Therefore, the PMF is the test for the adequacy of the dam and its spillway.

The estimated damage zone is described in Paragraph 1.2d of this report.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observation. In light of the apparent slides and/or slumps on the downstream slopes, the structural stability of sections of the embankment appears to be questionable. Large trees and rodent holes in the embankment could impair the structural stability of the dam. The effects of overtopping on structural and erosional stability are not known. The amount and extent of erosion that might be caused by high discharges through the spillway and the resultant effects upon the integrity of the structure are not known.

b. Design and Construction Data. No design or construction data were available. Seepage and stability analyses were not available, which is considered a deficiency.

c. Operating Records. There are no controlled operating facilities for this dam.

d. Post Construction Changes. The inspection team is not aware of any significant post construction changes on this dam. The shallow installation of electrical conduit on a short section of the downstream slope of the south leg and the installation of the sewer line along the toe of the north leg were performed after the dam was constructed. Neither installation should have a significant effect upon performance of the structure.

e. Seismic Stability. This dam is located in Seismic Zone 1. An earthquake of the magnitude predicted in this area is not ordinarily expected to cause structural failure of a dam of this height and character. However, due to the apparent slides and/or slumps in downstream sections of this dam, seismic forces should be included in stability analyses of the structure.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. The structural stability of this dam appears to be questionable. Seepage and stability analyses were not available which is considered a deficiency. Deficiencies in maintenance (trees on slopes, rodent holes, etc.) could ultimately increase the potential of failure of the embankment.

Based upon the approximate data available for analyses, the dam will not be overtopped by the 100-year nor the 50% PMF storms. The PMF (spillway design storm) will overtop the dam by about 1 foot and a breach failure of Upper Trenton Dam would probably overtop this dam by several feet.

Erosion of the outlet end of the spillway could impair the integrity of the spillway structure.

b. Adequacy of Information. Due to the lack of engineering data, the conclusions in this report are based upon performance history and visual observations. Seepage and stability analyses comparable to the requirements of the guidelines were not available which is considered a deficiency.

c. Urgency. The analyses and remedial measures recommended in paragraph 7.2 should be pursued on a high priority basis.

d. Necessity for Phase II. Phase II investigation is not considered necessary. However, the additional studies and analyses recommended in paragraph 7.2 should be accomplished in the near future.

e. Seismic Stability. This dam is located in Seismic Zone 1. An earthquake of this magnitude is not ordinarily expected to be hazardous to a dam of this height and character. Due to the presence of apparent slides in the downstream slopes of this dam, seismic forces should be included in analyzing the stability of this structure.

7.2 REMEDIAL MEASURES

a. Alternatives.

(1) Additional information should be obtained on the topographic characteristics of the reservoir area

to determine the increase in the height of dam or the size of the spillway that is necessary to pass the Probable Maximum Flood or the flood that could result from failure of Upper Trenton Dam without overtopping the dam.

(2) Additional studies should be performed to determine the cause, extent and potential effects on structural stability of the apparent slides in the downstream slopes of the dam.

(3) Seepage and stability analyses comparable to the "Recommended Guidelines for Safety Inspection of Dams" should be performed by a professional engineer experienced in the design and construction of dams for appropriate loading conditions including seismic forces, and made a matter of record.

(4) Additional studies should be made to determine the hydraulic characteristics of the spillway outlet structure and downstream channel and consequent effects on the integrity of the structure during high discharges through the spillway.

(5) The services of an engineer experienced in the design and construction of earth dams should be obtained to perform the above studies, analyses and evaluations and to design protective measures, if required.

b. O & M Procedures.

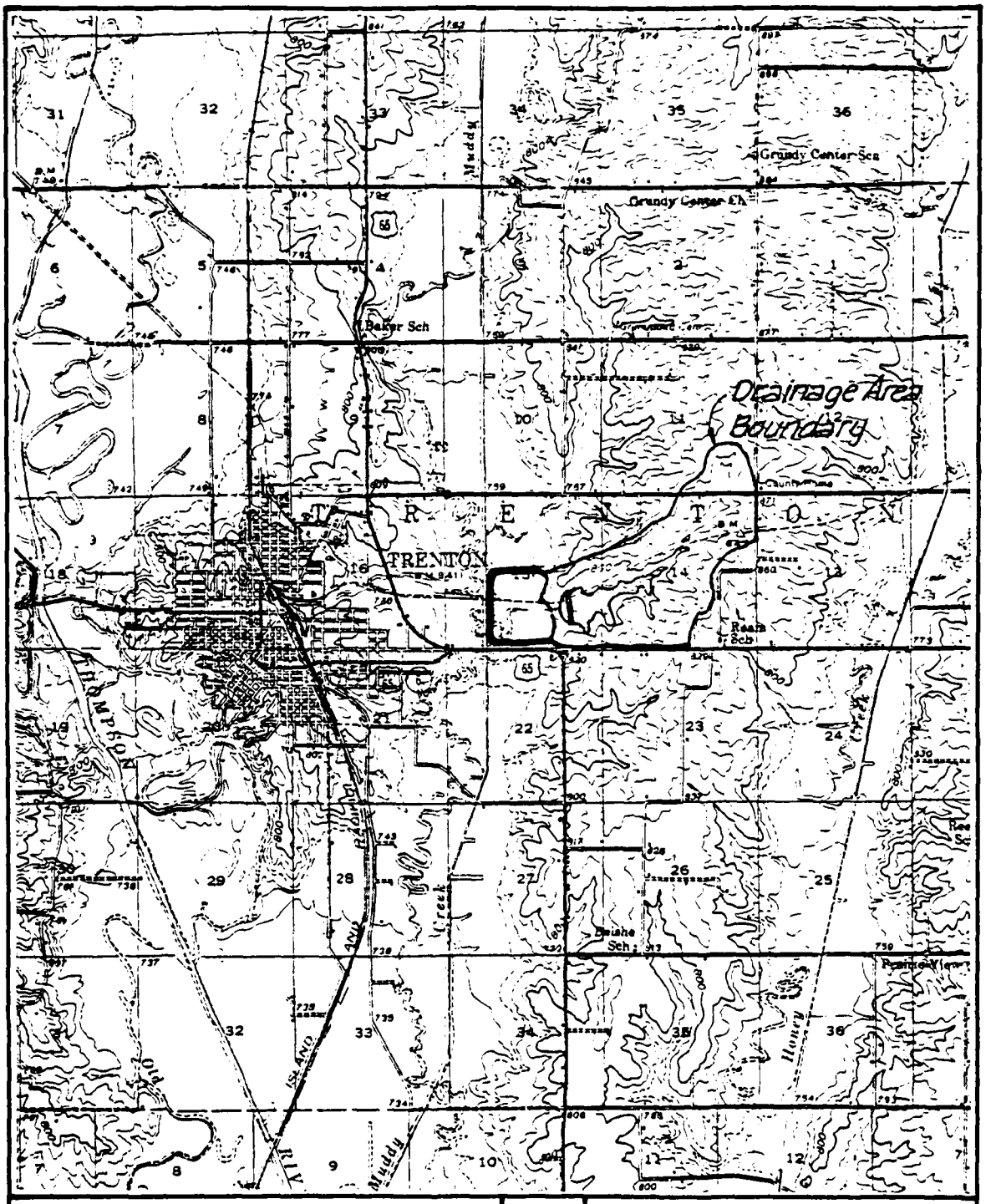
(1) Seepage and stability analyses should be performed by a professional engineer experienced in the design and construction of earth dams.

(2) Trees should be removed from the slopes of the dam and measures taken to prevent their recurrence. Removal of large trees should be done under the guidance of an engineer experienced in the design and construction of earth dams.

(3) Rodent holes on the crest and slopes of the embankment should be repaired.

(4) A program of periodic inspection and maintenance should be initiated to control tree and other vegetative growth and rodent activity on the dam and other deficiencies that could affect the stability and/or performance of the structure.

APPENDIX A
MAPS



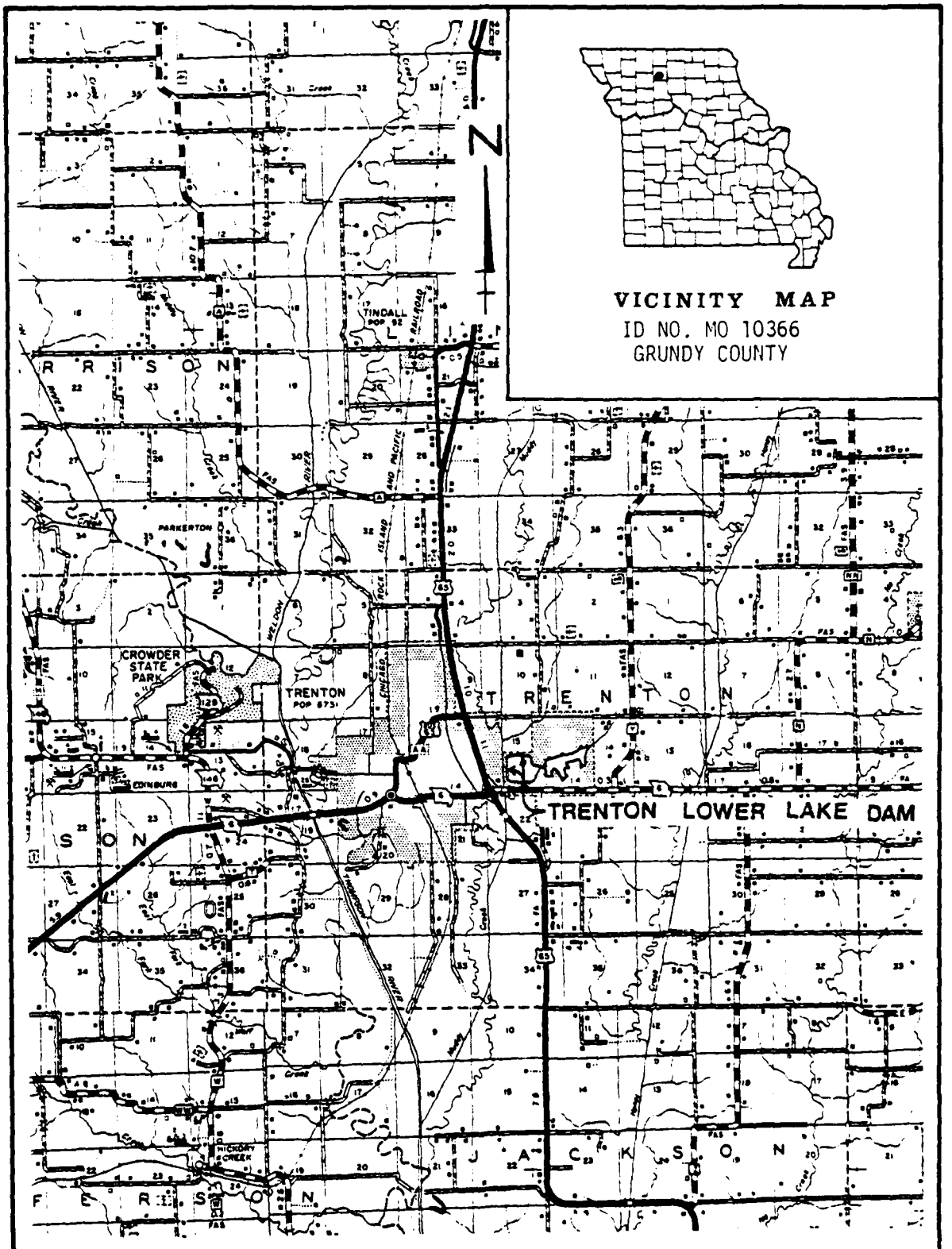
VICINITY TOPOGRAPHY

TRENTON LOWER LAKE DAM

GRUNDY COUNTY, MISSOURI

MO. 10366

PLATE A-1


N
VICINITY MAP
ID NO. MO 10366
GRUNDY COUNTY
TINDALL
POP 92
R R I S O N
PARKERTON
CROWDER STATE PARK
TRENTON
POP 8731
T R E N T O N
TRENTON LOWER LAKE DAM
S O N
J A C K S O N
F E R R I S O N
HICKORY CREEK
Scale in miles
0 1 2 3 4 5
LOCATION MAP
PLATE A-2

APPENDIX B
PHOTOGRAPHS

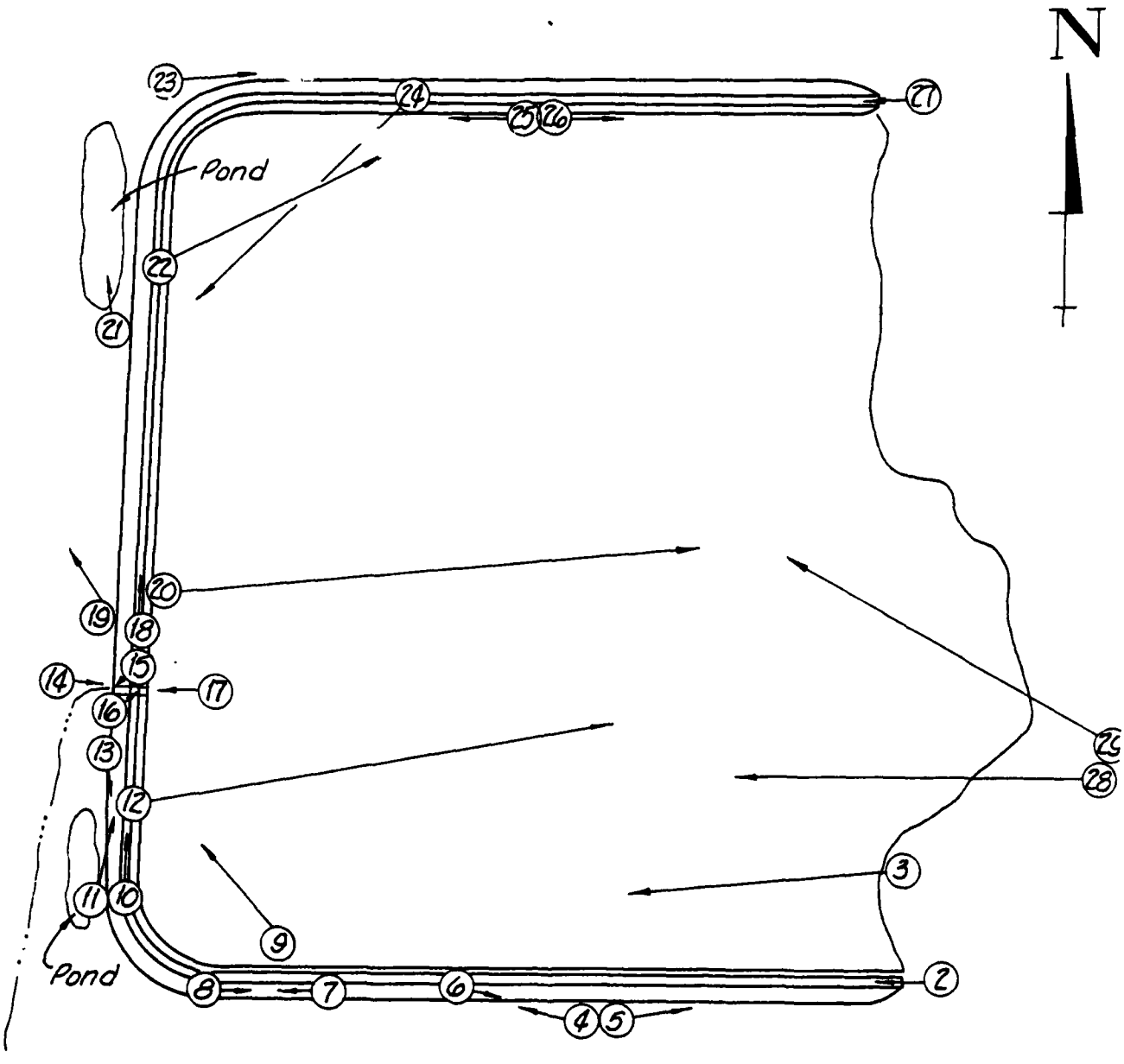


PHOTO INDEX

TRENTON LOWER LAKE DAM

GRUNDY COUNTY, MISSOURI

MO. 10366

PLATE B-1

PHOTO NO. 2 CREST OF SOUTH LEG TAKEN FROM EAST END

PHOTO NO. 3 UPSTREAM SLOPE OF SOUTH LEG

PHOTO NO. 4 DOWNSTREAM SLOPE TAKEN FROM STA. 7+00
LOOKING WEST

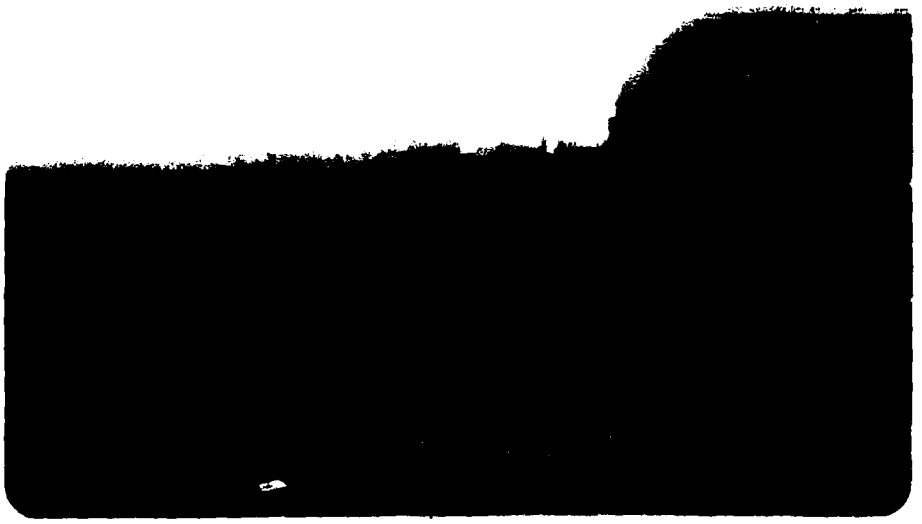


PHOTO NO. 5 DOWNSTREAM SLOPE TAKEN FROM STA. 7+00
LOOKING EAST

PHOTO NO. 6 SLUMP AREA FROM STA. 10+15 TO 11+00.
TREES GROWING IN SLUMP AREA

PHOTO NO. 7

LONGITUDINAL CRACK
STA. 16+80 TO 17+10

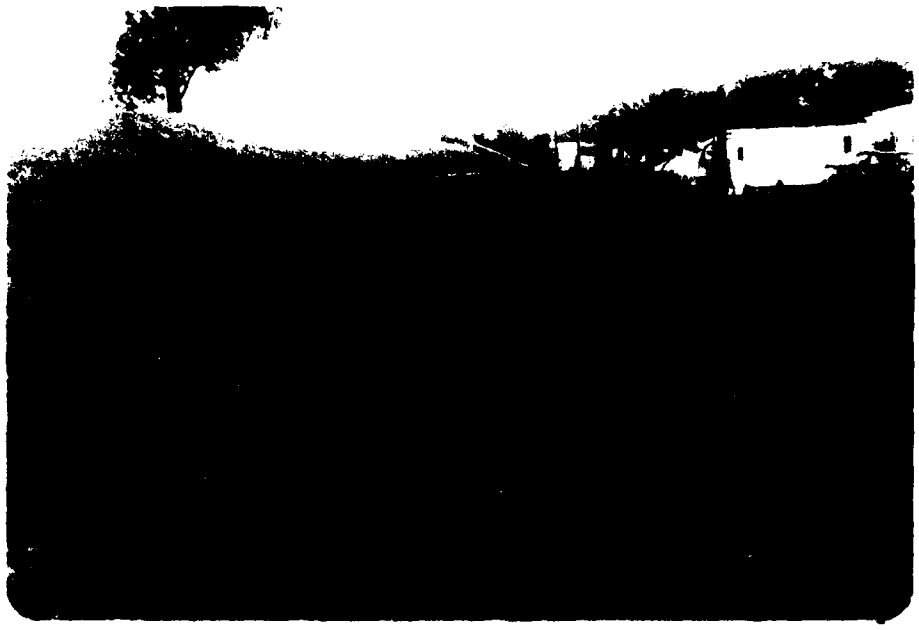


PHOTO NO. 8 CRACK AND EROSION RESULT OF INSTALLATION OF UNDERGROUND POWER LINE

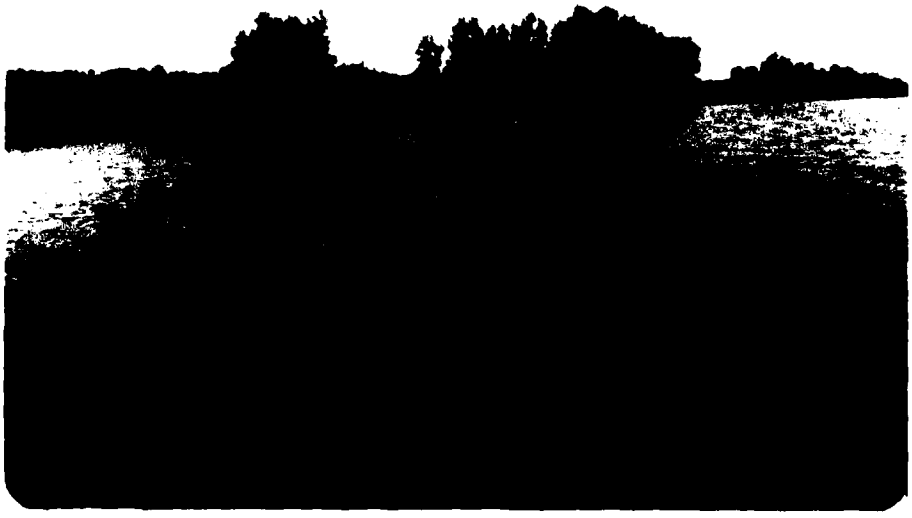


PHOTO NO. 9 UPSTREAM SLOPE OF WEST LEG TAKEN FROM STA. 18+25

PHOTO NO. 10 CREST OF WEST LEG LOOKING NORTH FROM STA. 21+00

PHOTO NO. 11 DOWNSTREAM SLOPE OF WEST LEG FROM STA. 21+00 LOOKING NORTH

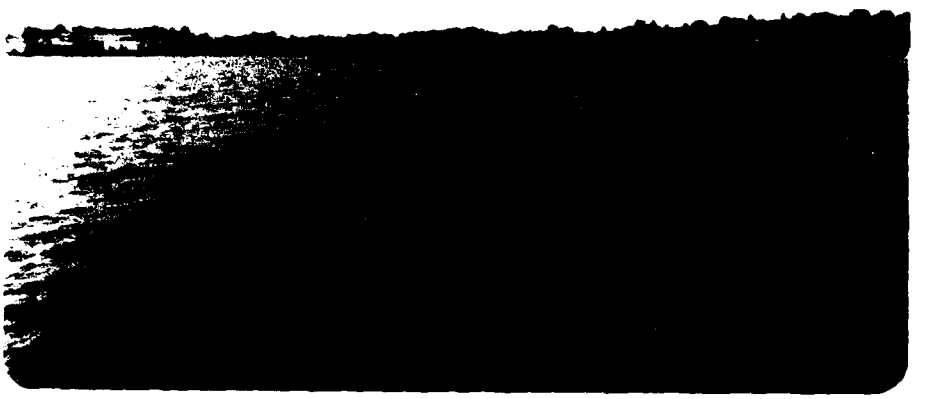


PHOTO NO. 12 UPSTREAM ACROSS LAKE FROM STA. 22+25

PHOTO NO. 13 DOWNSTREAM SLOPE FROM STA. 25+50 TO SOUTH. 2H TO 1V SLOPE FROM MIDWAY UP SLOPE TO TOE

PHOTO NO. 14 VIEW OF SPILLWAY FROM DOWNSTREAM CHANNEL

PHOTO NO. 15 VIEW OF SPILLWAY DROP STRUCTURE

PHOTO NO. 16 VIEW UPSTREAM IN SPILLWAY FROM DROP STRUCTURE

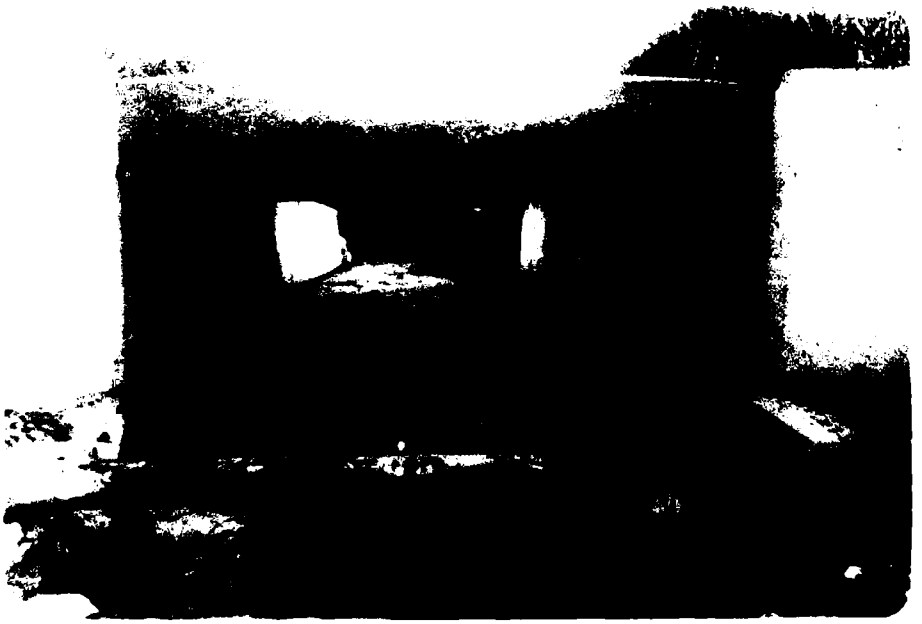


PHOTO NO. 17 VIEW DOWNSTREAM IN SPILLWAY

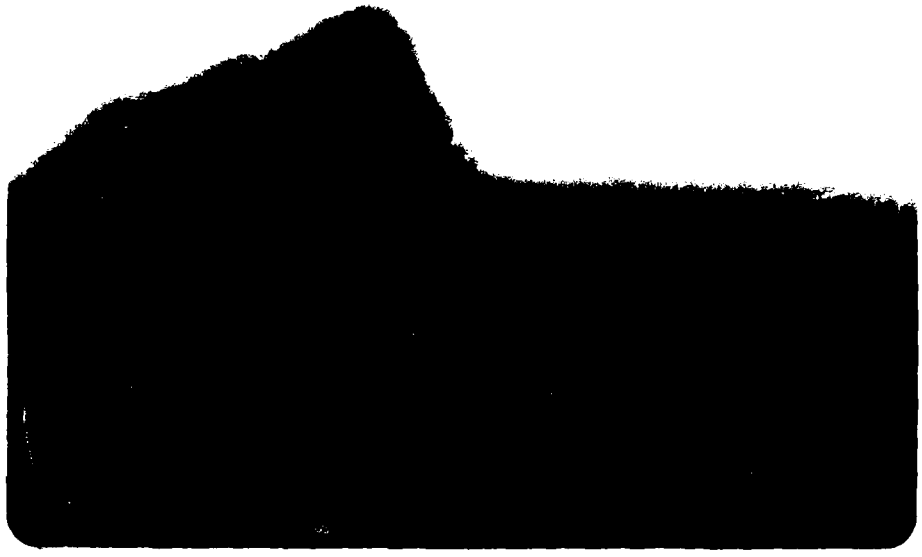


PHOTO NO. 18 CREST OF WEST LEG LOOKING NORTH FROM SPILLWAY

PHOTO NO. 19 VIEW DOWNSTREAM FROM STA. 30+00

PHOTO NO. 20 UPSTREAM FROM STA. 30+00

PHOTO NO. 21 POND AT TOE OF WEST LEG. STA. 36+00 TO 40+00

PHOTO NO. 22 UPSTREAM SLOPE OF NORTH LEG TAKEN FROM STA. 36+00 ON WEST LEG

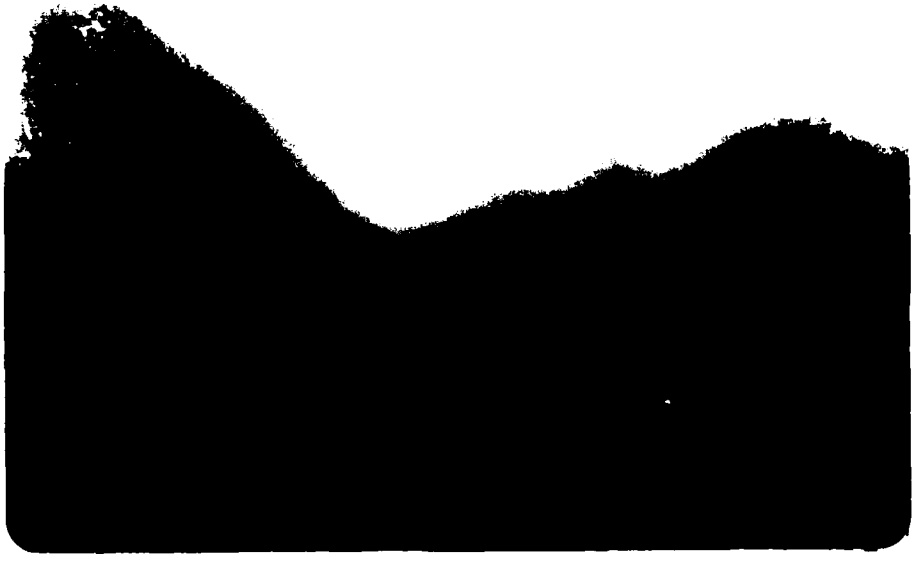


PHOTO NO. 23 DOWNSTREAM SLOPE OF NORTH LEG TAKEN FROM WEST LEG

PHOTO NO. 24 UPSTREAM SLOPE OF WEST LEG TAKEN FROM NORTH LEG

PHOTO NO. 25 UPSTREAM SLOPE OF NORTH LEG LOOKING WEST

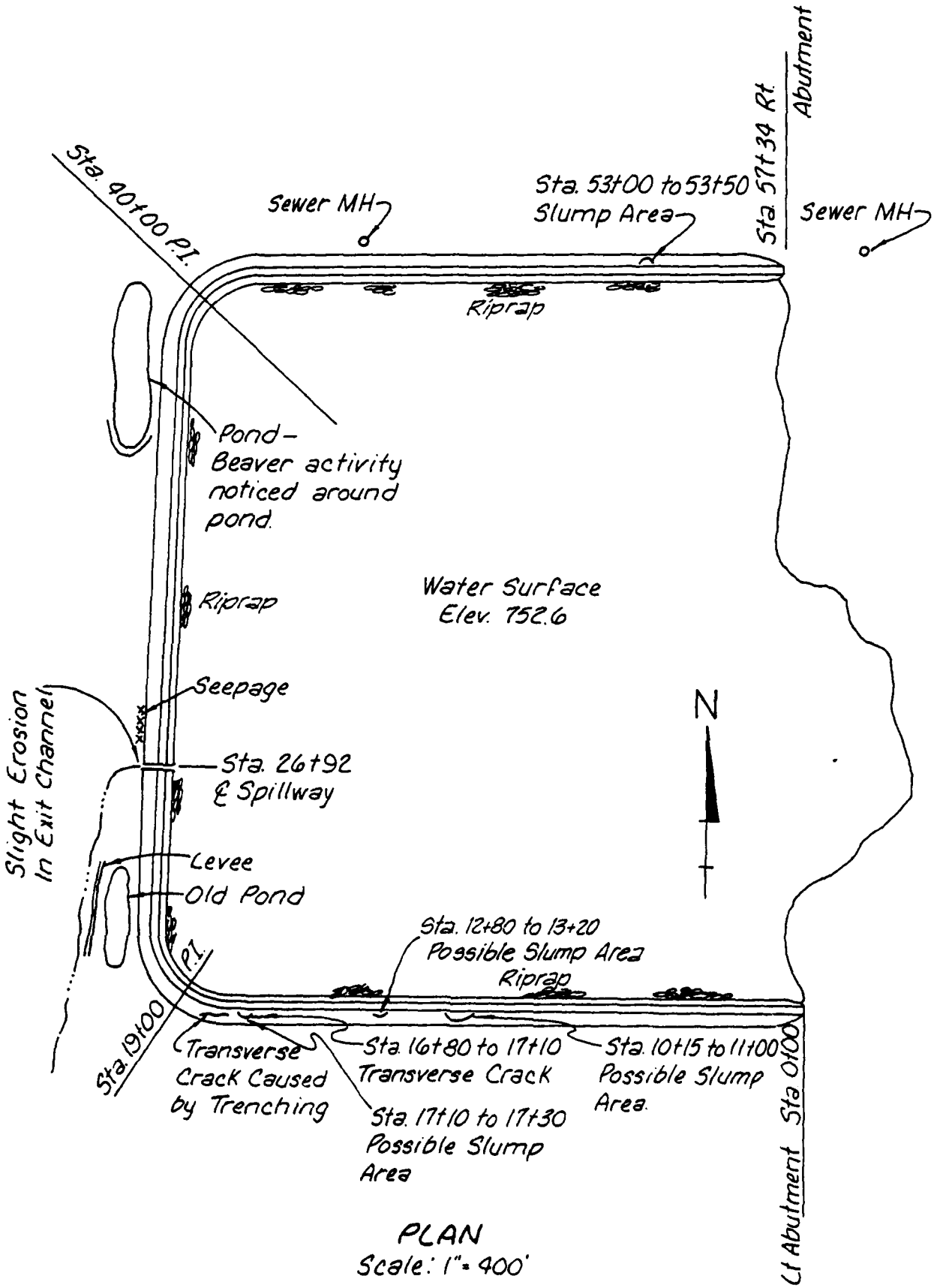
PHOTO NO. 26 UPSTREAM SLOPE OF NORTH LEG LOOKING EAST

PHOTO NO. 27 CREST OF NORTH LEG TAKEN FROM EAST END

PHOTO NO. 28 OVERVIEW TAKEN FROM TRENTON UPPER LAKE DAM

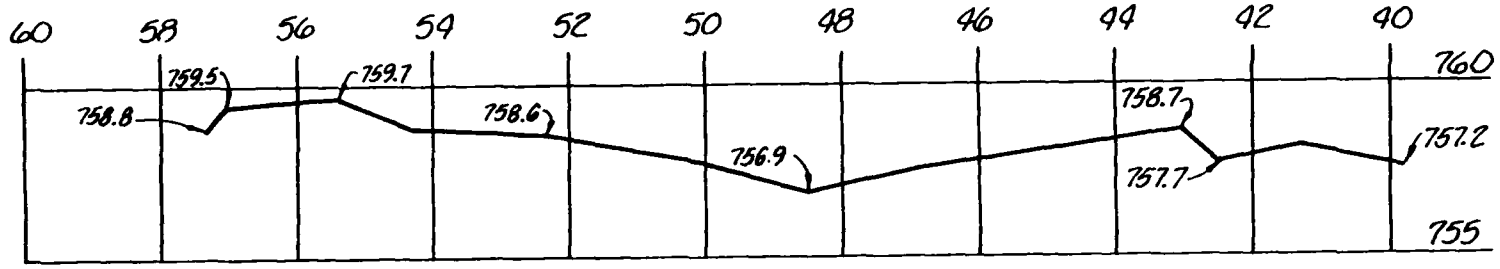
PHOTO NO. 29 OVERVIEW TAKEN FROM TRENTON UPPER LAKE DAM

APPENDIX C
PROJECT PLATES

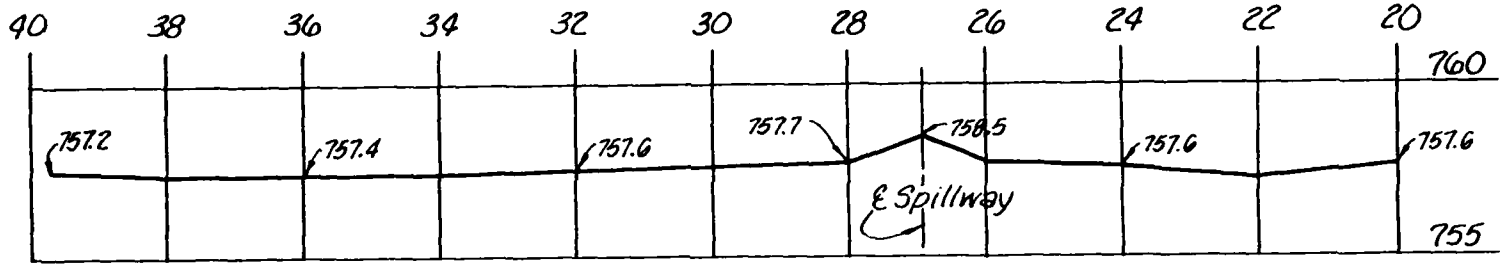


PLAN
Scale: 1" = 400'

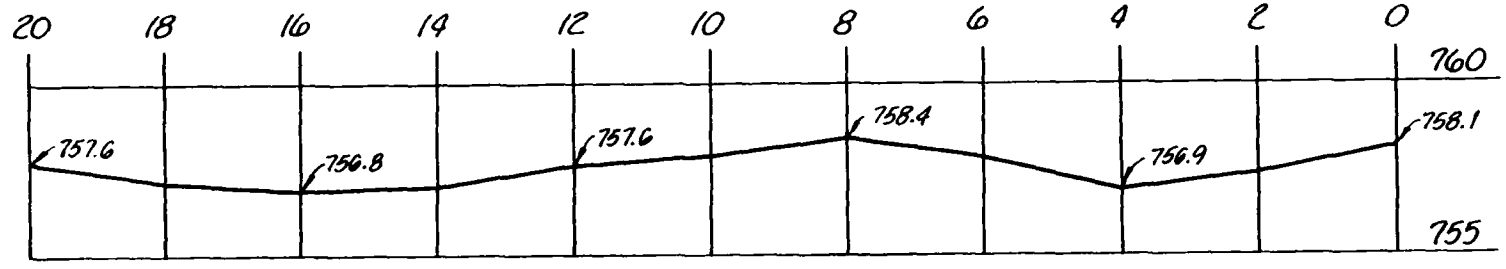
PLATE C-1



℄ PROFILE - NORTH LEG OF DAM CREST



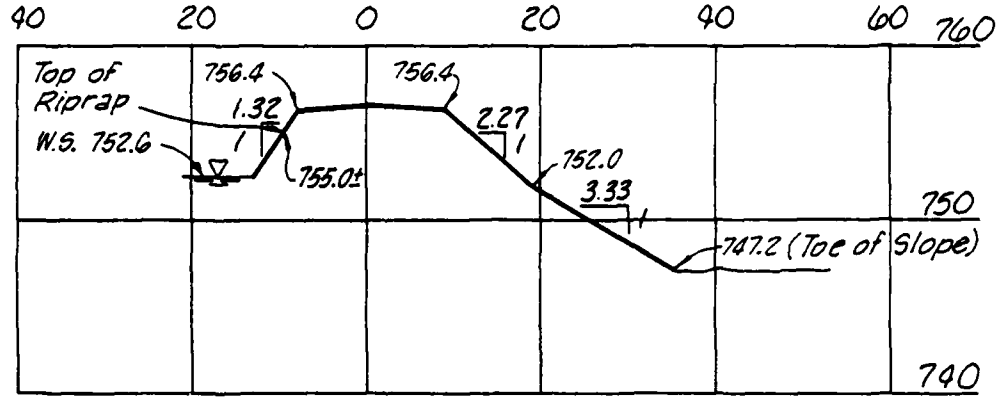
℄ PROFILE - WEST LEG OF DAM CREST



℄ PROFILE - SOUTH LEG OF DAM CREST

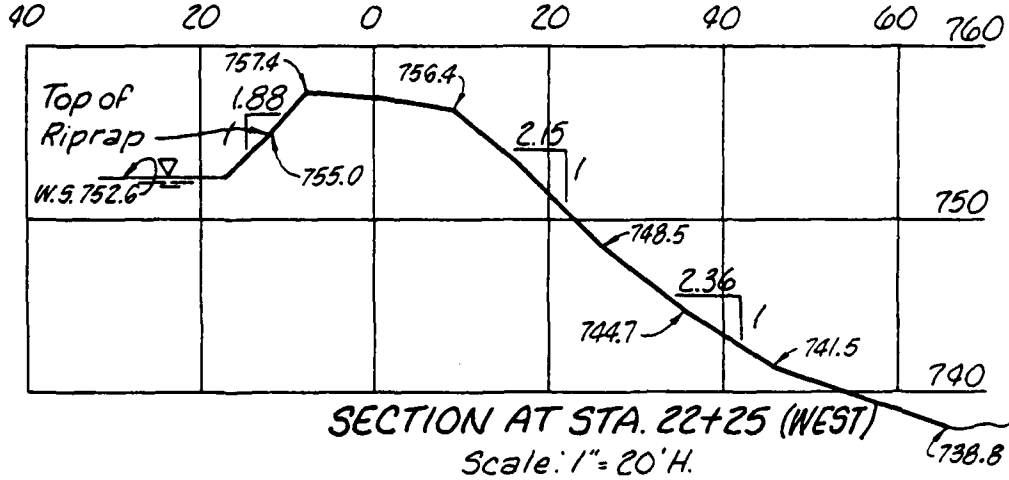
Scale: 1" = 250' H.
1" = 5' V.

PLATE C-2



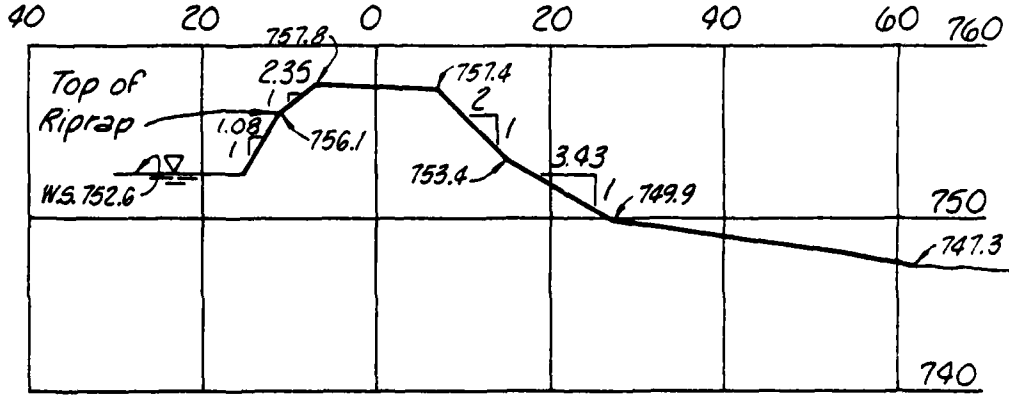
SECTION AT STA. 17+00 (SOUTH)

Scale: 1" = 20' H.
1" = 10' V.



SECTION AT STA. 22+25 (WEST)

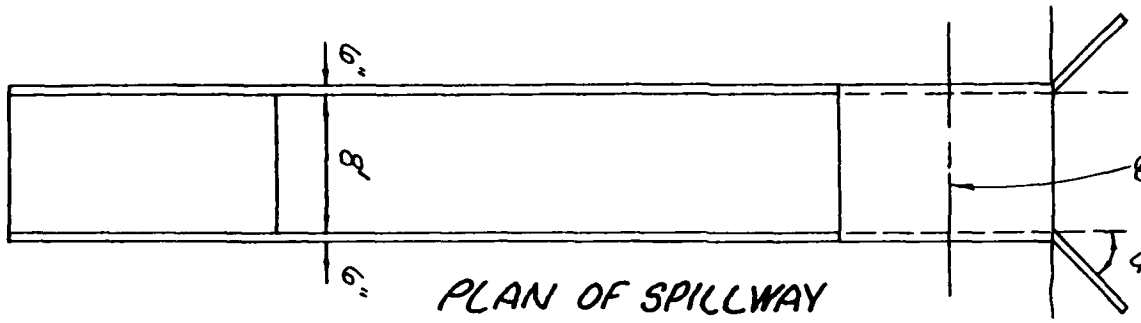
Scale: 1" = 20' H.
1" = 10' V.



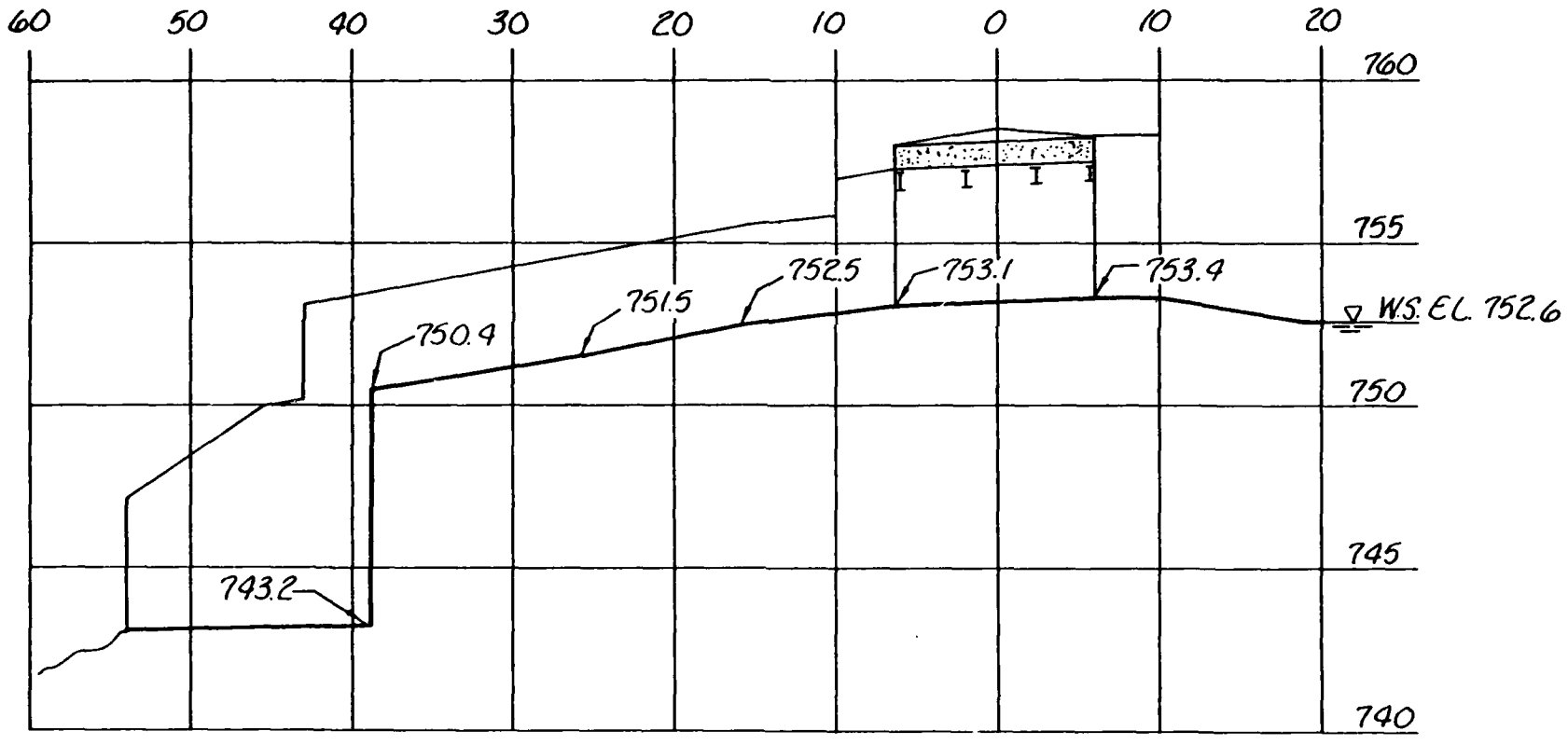
SECTION AT STA. 42+25 (NORTH)

Scale: 1" = 20' H.
1" = 10' V.

PLATE C-3



PLAN OF SPILLWAY



PROFILE OF SPILLWAY

Scale : 1" = 10' H.

1" = 5' V.

PLATE C-4

APPENDIX D
HYDRAULIC AND HYDROLOGIC DATA

HYDROLOGIC COMPUTATIONS

1. The SCS dimensionless unit hydrograph and the systemized computer program HEC-1 (Dam Safety Version), July 1978, prepared by the Hydrologic Engineering Center, U.S. Corps of Engineers, Davis, California, were used to develop the inflow hydrographs.

   a. Twenty-four hour, 100-year rainfall for the dam location was taken from the data for the rainfall station at Maryville, MO. as supplied by the St. Louis District, Corps of Engineers per their letter dated March 6, 1979. The twenty-four hour probable maximum precipitation was taken from the curves of the Hydrometeorological Report No. 33 and current Corps of Engineers and St. Louis District policy and guidance for hydraulics and hydrology.

   b. Drainage area = 1.114 square miles (713 acres).

   c. Time of concentration of runoff = (See paragraph 1.g of this Section.)

   d. The antecedent storm conditions for the probable maximum precipitation were heavy rainfall and low temperatures which occurred on the previous 5 days (SCS AMC III). The antecedent storm conditions for the 100-year precipitation were an average of the conditions which have preceded the occurrence of the maximum annual flood on numerous watersheds (SCS AMC II). The initial pool elevation was assumed at the invert of the spillway.

   e. The total twenty-four hour storm duration losses for the 100-year storm were 1.64 inches. The total losses for the PMF storm were 0.75 inches. These data are based on SCS runoff curve No. 94 and No. 86 for antecedent moisture conditions SCS AMC III and AMC II respectively. The watershed consists of the Upper Trenton Lake's watershed, the downstream slope of the Upper Trenton Dam and the Lower Trenton reservoir. The Upper Trenton watershed consists of soils from SCS soil groups C and D with land usage made up of cropland and urban areas with some woods.

   f. Average soil loss rates = 0.03 inch per hour approximately (for PMF storm, AMC III).

g. The inflow hydrograph for the reservoir was composed of two components. The rainfall on the lower reservoir and the downstream slope of the Upper Trenton Dam was converted into direct runoff and combined with the outflow hydrograph from the Upper Trenton Dam to produce the inflow hydrograph for the Lower Trenton Dam.

2. The combined discharge rating consisted of two components: the flow through the spillway and the flow going over the top of the dam.

   a. The spillway ratings were developed using the Corps of Engineers Water Surface Profile HEC-2 computer program.

   b. The flows over the dam were developed using the dam overtopping analysis (irregular dam top) within the HEC-1 (Dam Safety Version) program.

3. Floods were routed through the reservoir using the HEC-1 (Dam Safety Version) program to determine the capabilities of the spillway and dam embankment crest. The Upper Trenton Dam and Lower Trenton Dam were routed in series due to the fact that the Upper Trenton Dam discharges directly into the Lower Trenton reservoir. The input-output for several ratios of the PMF and the plotted hydrograph for the PMF are attached in this Appendix.

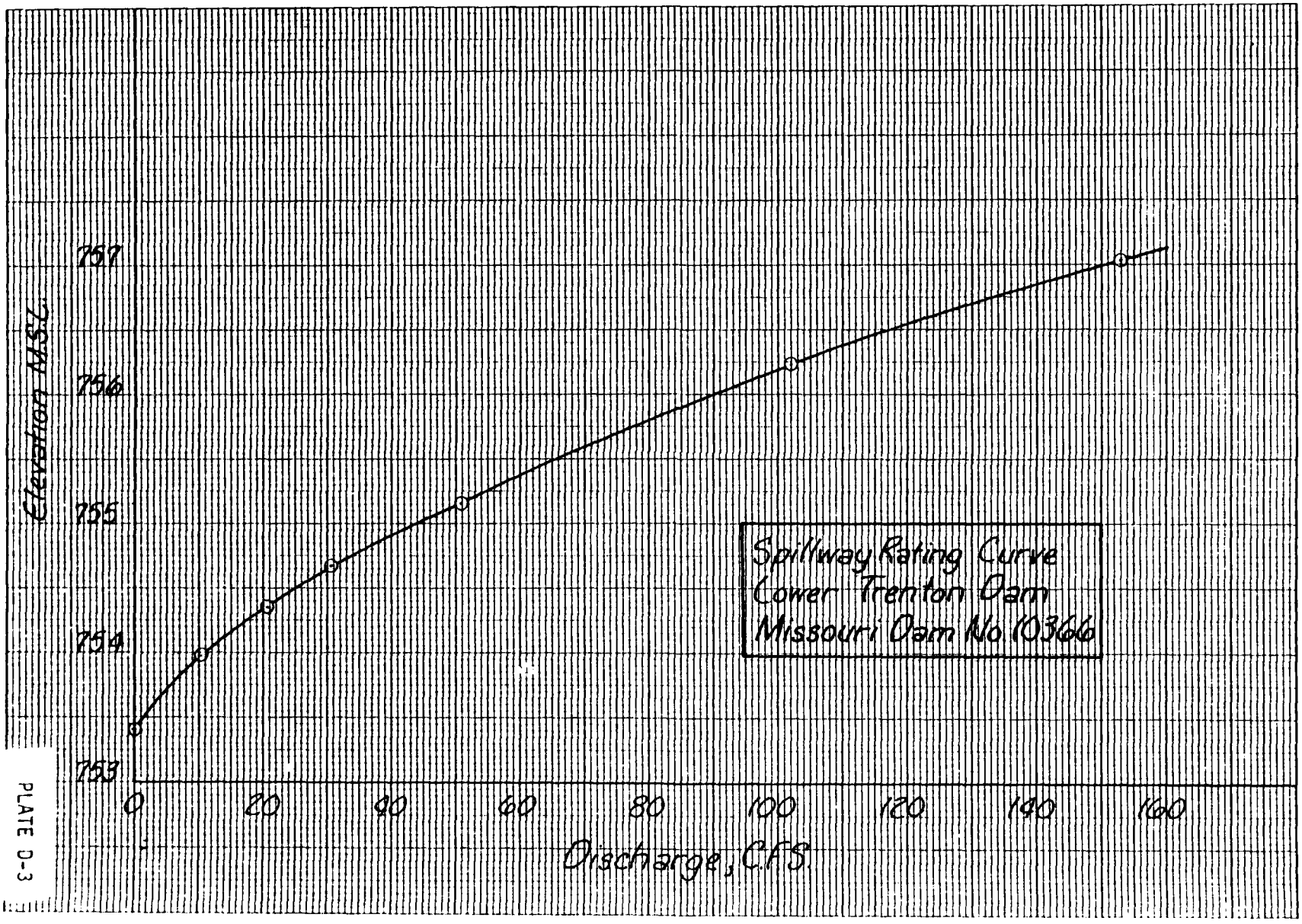
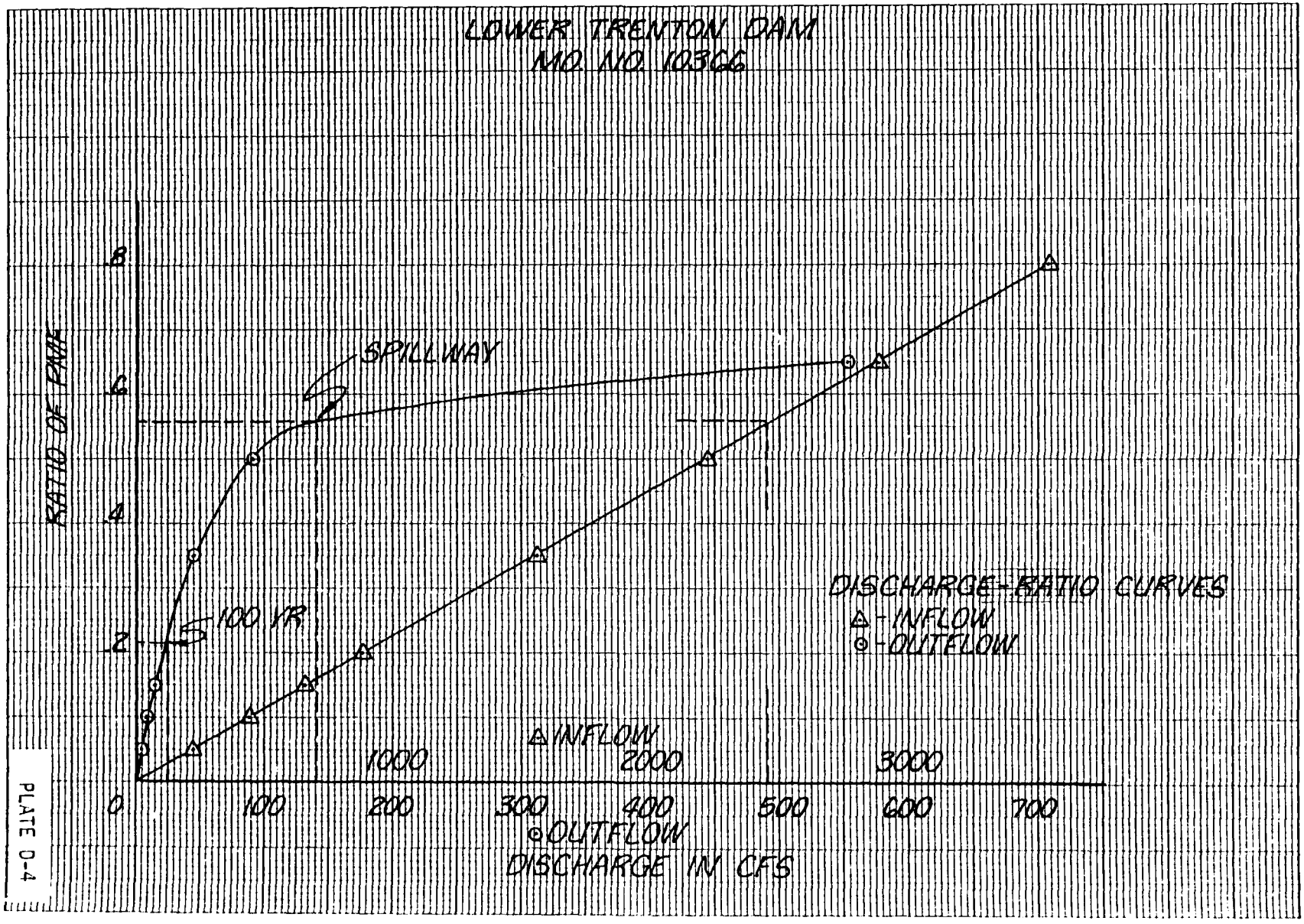

Elevation MSL
757
756
755
754
753
0
20
40
60
80
100
120
140
160
Discharge, C.F.S.
Spillway Rating Curve
Lower Trenton Dam
Missouri Dam No 10366

PLATE D-3


LOWER TRENTON DAM
MO. NO. 10366
RATIO OF FLOW
8
6
4
2
0
SPILLWAY
100 YR
DISCHARGE-RATIO CURVES
△-INFLOW
⊙-OUTFLOW
△INFLOW
1000
2000
3000
100
200
300
400
500
600
700
⊙OUTFLOW
DISCHARGE IN CFS
PLATE D-4

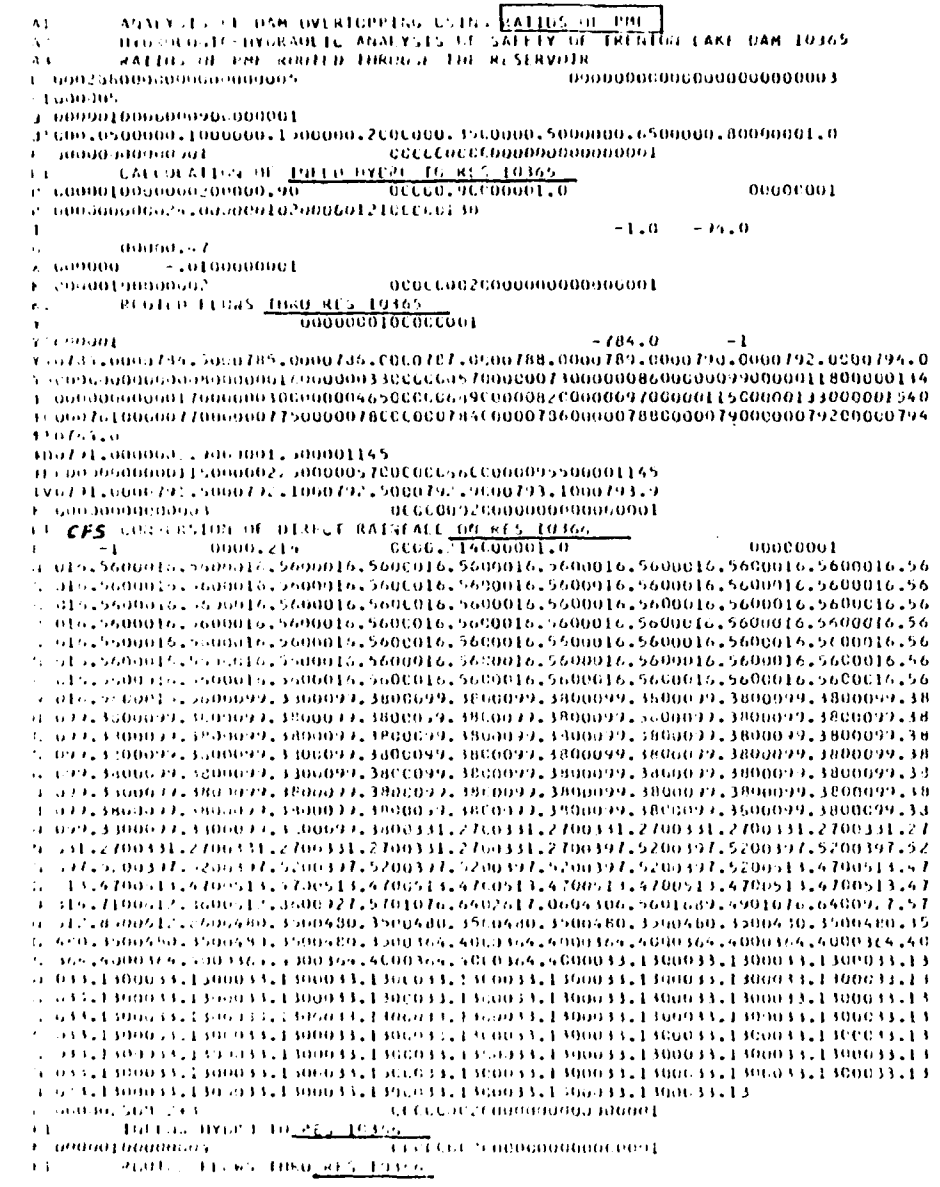


PLATE D-5

PLATE D-6

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT	000001
ROUTE HYDROGRAPH TO	000002
RUNOFF HYDROGRAPH AT	000003
COMBINE 2 HYDROGRAPHS AT	M 2+3
ROUTE HYDROGRAPH TO	000004
END OF NETWORK	

PLATE D-7

CFS	5157.	1950.	587.	587.	168929.
CMS	146.	52.	17.	17.	4784.
INCHES		19.12	24.25	24.25	24.25
MM		485.71	615.96	615.96	615.96
AC-FT		917.	1163.	1163.	1163.
THOUS CU M		1132.	1435.	1435.	1435.

HYDROGRAPH AT STA0C0001 FOR PLAN 1, RATIO 9 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6446.	2313.	733.	733.	211161.
CMS	183.	65.	21.	21.	5979.
INCHES		23.30	30.31	30.31	30.31
MM		607.14	769.95	769.95	769.95
AC-FT		1147.	1454.	1454.	1454.
THOUS CU M		1415.	1794.	1794.	1794.

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTED FLOWS THRU RES 10365

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
0C0002	1	0	0	2	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP		LSTR
0.0	0.000	0.00	1	1	0	0		0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-784.	-1

ELEV	783.00	784.50	785.00	786.00	787.00	788.00	789.00	790.00	792.00	794.00
FLOW	0.00	0.00	16.00	33.00	57.00	73.00	86.00	99.00	118.00	134.00
SPACE	0.	170.	330.	465.	689.	820.	970.	1150.	1330.	1540.
ELEVATION	781.	770.	775.	780.	784.	786.	789.	790.	792.	794.

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
784.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
791.0	2.9	1.5	1145.

SPILLWAY CREST	0.	115.	225.	570.	660.	955.	1145.
AREA							
ELEVATION	781.0	781.5	782.1	782.5	782.7	783.1	783.3

STATION 0SC002, PLAN 1, RATIO 1

(*)=AT-SITE HYDROGRAPH ORDINATES

PLATE D-8

STATION 000002, PLAN 1, RATIO 9 PMF

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	3.
3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
4.	4.	4.	4.	4.	4.	4.	5.	5.	5.
6.	6.	7.	7.	8.	9.	9.	10.	10.	11.
12.	12.	13.	14.	14.	15.	16.	16.	17.	18.
18.	19.	20.	21.	21.	22.	23.	23.	24.	25.
26.	26.	27.	28.	28.	29.	30.	31.	31.	32.
33.	33.	34.	35.	36.	37.	38.	39.	40.	40.
41.	42.	43.	44.	45.	46.	46.	47.	48.	49.
50.	51.	51.	52.	53.	54.	55.	56.	57.	58.
60.	61.	63.	64.	66.	68.	69.	71.	73.	74.
76.	77.	79.	80.	82.	83.	85.	86.	88.	89.
91.	93.	94.	96.	98.	100.	101.	102.	104.	105.
107.	108.	110.	113.	140.	177.	246.	363.	540.	808.
1504.	2302.	3262.	3953.	4429.	4602.	4551.	4366.	4120.	3857.
3601.	3365.	3156.	2975.	2819.	2684.	2567.	2463.	2368.	2280.
2199.	2123.	2054.	1991.	1935.	1885.	1840.	1797.	1750.	1694.
1629.	1560.	1486.	1349.	1244.	1146.	1054.	973.	900.	836.
790.	730.	686.	647.	612.	582.	554.	530.	508.	488.
470.	454.	437.	424.	411.	398.	387.	375.	363.	352.
342.	333.	324.	316.	308.	301.	294.	288.	282.	276.
270.	265.	260.	256.	251.	247.	243.	239.	235.	232.
228.	225.	222.	219.	217.	214.	211.	209.	207.	204.
202.	200.	199.	196.	194.	192.	191.	189.		

STORAGE

689.	689.	689.	689.	689.	689.	689.	689.	689.	689.
689.	689.	689.	689.	689.	689.	689.	689.	689.	689.
689.	689.	689.	689.	690.	690.	690.	690.	690.	690.
691.	691.	691.	691.	691.	692.	692.	692.	692.	693.
693.	693.	694.	694.	694.	694.	695.	695.	695.	696.
696.	696.	697.	697.	698.	698.	698.	699.	699.	699.
700.	700.	701.	701.	701.	702.	702.	702.	703.	703.
704.	704.	705.	705.	706.	706.	707.	708.	710.	711.
713.	715.	717.	719.	722.	724.	727.	729.	732.	734.
737.	740.	742.	745.	748.	750.	753.	756.	759.	761.
764.	767.	769.	772.	775.	778.	780.	783.	786.	789.
791.	794.	797.	800.	802.	805.	808.	810.	813.	816.
818.	821.	824.	827.	829.	832.	835.	838.	840.	843.
846.	848.	851.	854.	856.	859.	862.	865.	867.	870.
873.	875.	878.	880.	883.	886.	889.	892.	897.	902.
907.	913.	921.	929.	937.	945.	954.	962.	971.	980.
990.	999.	1007.	1020.	1030.	1041.	1051.	1062.	1073.	1084.
1095.	1106.	1119.	1130.	1143.	1155.	1168.	1182.	1195.	1208.
1222.	1236.	1249.	1263.	1276.	1291.	1307.	1327.	1351.	1381.
1414.	1443.	1461.	1486.	1496.	1500.	1499.	1495.	1489.	1484.
1478.	1472.	1467.	1462.	1456.	1454.	1451.	1448.	1445.	1442.
1439.	1437.	1434.	1431.	1430.	1428.	1426.	1425.	1423.	1421.
1419.	1414.	1410.	1405.	1400.	1395.	1391.	1386.	1381.	1377.
1373.	1369.	1365.	1362.	1359.	1356.	1353.	1350.	1347.	1345.

PLATE D-9

1342.	1340.	1338.	1336.	1334.	1332.	1330.	1328.	1327.	1325.
1323.	1322.	1321.	1320.	1316.	1317.	1316.	1315.	1314.	1313.
1312.	1311.	1310.	1309.	1308.	1307.	1307.	1306.	1305.	1304.
1304.	1303.	1302.	1302.	1301.	1300.	1300.	1299.	1299.	1298.
1297.	1297.	1296.	1296.	1295.	1295.	1295.	1294.		

STAGE

784.0	784.0	784.0	784.0	784.0	784.0	784.0	784.0	784.0	784.0
784.0	784.0	784.0	784.0	784.0	784.0	784.0	784.0	784.0	784.0
784.0	784.0	784.0	784.0	784.0	784.0	784.0	784.0	784.0	784.0
784.0	784.0	784.0	784.0	784.0	784.0	784.0	784.0	784.1	784.1
784.1	784.1	784.1	784.1	784.1	784.1	784.1	784.1	784.1	784.1
784.1	784.1	784.1	784.1	784.1	784.1	784.1	784.1	784.2	784.2
784.2	784.2	784.2	784.2	784.2	784.2	784.2	784.2	784.2	784.2
784.2	784.2	784.2	784.2	784.3	784.3	784.3	784.3	784.3	784.3
784.4	784.4	784.4	784.5	784.5	784.5	784.6	784.6	784.7	784.7
784.7	784.8	784.8	784.9	784.9	784.9	785.0	785.0	785.1	785.1
785.1	785.2	785.2	785.3	785.3	785.4	785.4	785.4	785.5	785.5
785.6	785.6	785.6	785.7	785.7	785.8	785.8	785.9	785.9	785.9
786.0	786.0	786.1	786.1	786.1	786.2	786.2	786.2	786.3	786.3
786.3	786.4	786.4	786.5	786.5	786.5	786.6	786.6	786.6	786.7
786.7	786.7	786.8	786.8	786.8	786.9	786.9	787.0	787.0	787.1
787.2	787.3	787.3	787.4	787.6	787.7	787.8	787.9	788.0	788.1
788.2	788.3	788.4	788.6	788.7	788.8	788.9	789.0	789.1	789.3
789.4	789.5	789.6	789.8	789.9	790.1	790.2	790.4	790.5	790.6
790.8	791.0	791.1	791.3	791.4	791.6	791.7	792.0	792.2	792.5
792.8	793.1	793.3	793.5	793.6	793.6	793.6	793.6	793.5	793.5
793.4	793.4	793.3	793.3	793.2	793.2	793.2	793.1	793.1	793.1
793.0	793.0	793.0	793.0	793.0	792.9	792.9	792.9	792.9	792.9
792.9	792.8	792.8	792.7	792.7	792.6	792.6	792.5	792.5	792.4
792.4	792.4	792.3	792.3	792.3	792.2	792.2	792.2	792.2	792.1
792.1	792.1	792.1	792.1	792.0	792.0	792.0	792.0	792.0	791.9
791.9	791.9	791.9	791.9	791.9	791.9	791.8	791.8	791.8	791.8
791.8	791.8	791.8	791.8	791.8	791.7	791.7	791.7	791.7	791.7
791.7	791.7	791.7	791.7	791.7	791.7	791.7	791.7	791.7	791.6
791.6	791.6	791.6	791.6	791.6	791.6	791.6	791.6		

PEAK OUTFLOW IS 4602. AT TIME 16.33 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4602.	1546.	428.	428.	123392.
CMS	130.	44.	12.	12.	3494.
INCHES		15.98	17.71	17.71	17.71
MM		405.77	449.92	449.92	449.92
AC-FT		766.	850.	850.	850.
THOUS CU M		945.	1048.	1048.	1048.

STATION.CCCCC2

INFLOW(I), OUTFLOW(O) AND OBSERVED FLOW(*)

	0.	1000.	2000.	3000.	4000.	5000.	6000.	7000.	0.	0.	0.	0.	0.
.05	11												
.10	21												
.15	31												
.20	41												
.25	51												
.30	61												
.35	71												
.40	81												
.45	91												
.50	101												
.55	111												
1.00	121												
1.05	131												
1.10	141												
1.15	151												
1.20	161												
1.25	171												
1.30	181												
1.35	191												
1.40	201												
1.45	211												
1.50	221												
1.55	231												
2.00	241												
2.05	251												
2.10	261												
2.15	271												
2.20	281												
2.25	291												
2.30	301												
2.35	311												
2.40	321												
2.45	331												
2.50	341												
2.55	351												
3.00	361												
3.05	371												
3.10	381												
3.15	391												
3.20	401												
3.25	411												
3.30	421												
3.35	431												
3.40	441												
3.45	451												
3.50	461												
3.55	471												
4.00	481												
4.05	491												
4.10	501												
4.15	511												
4.20	521												
4.25	531												
4.30	541												
4.35	551												
4.40	561												

PLATE D-11

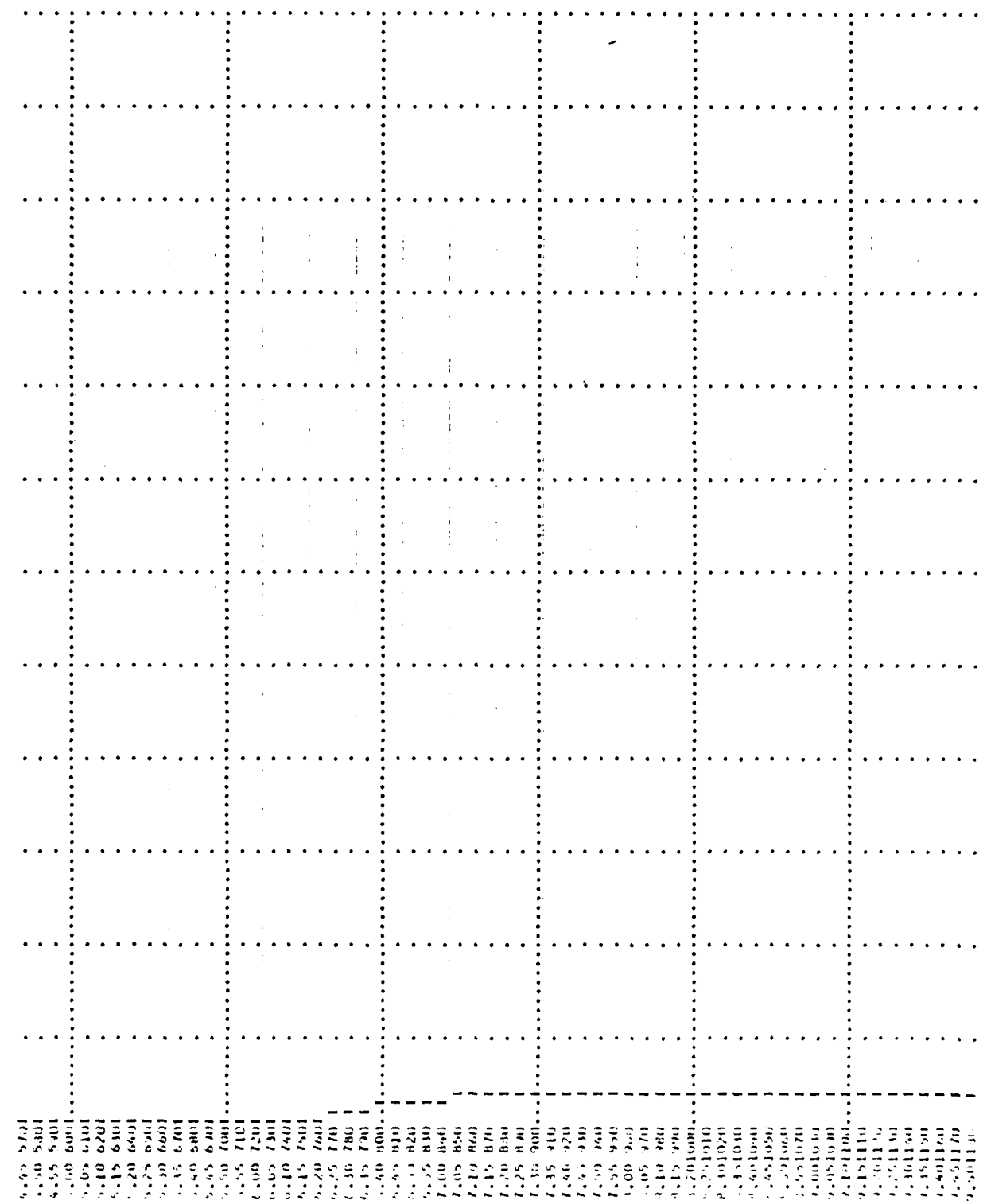


PLATE D-12

PLATE D-13

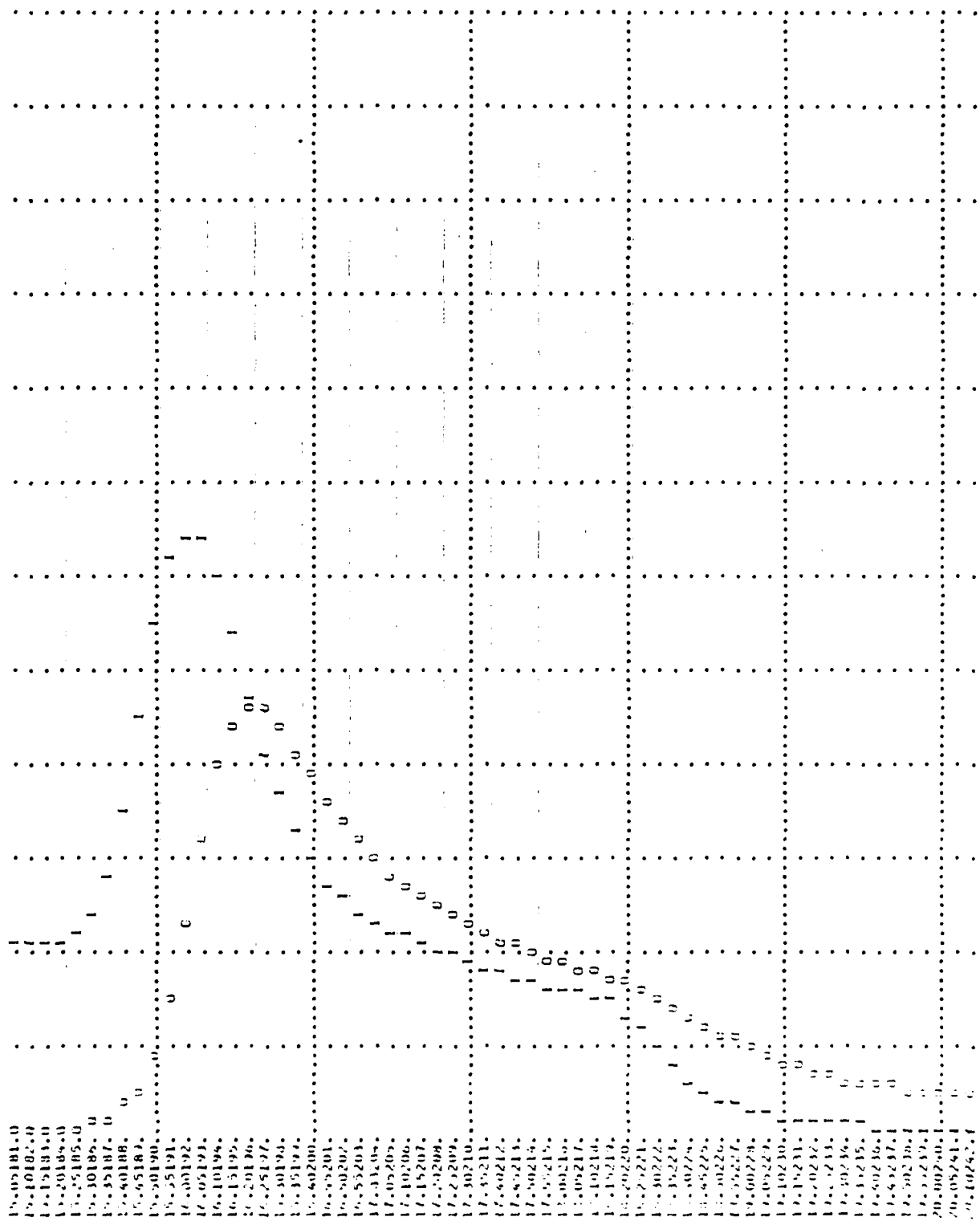


PLATE D-14

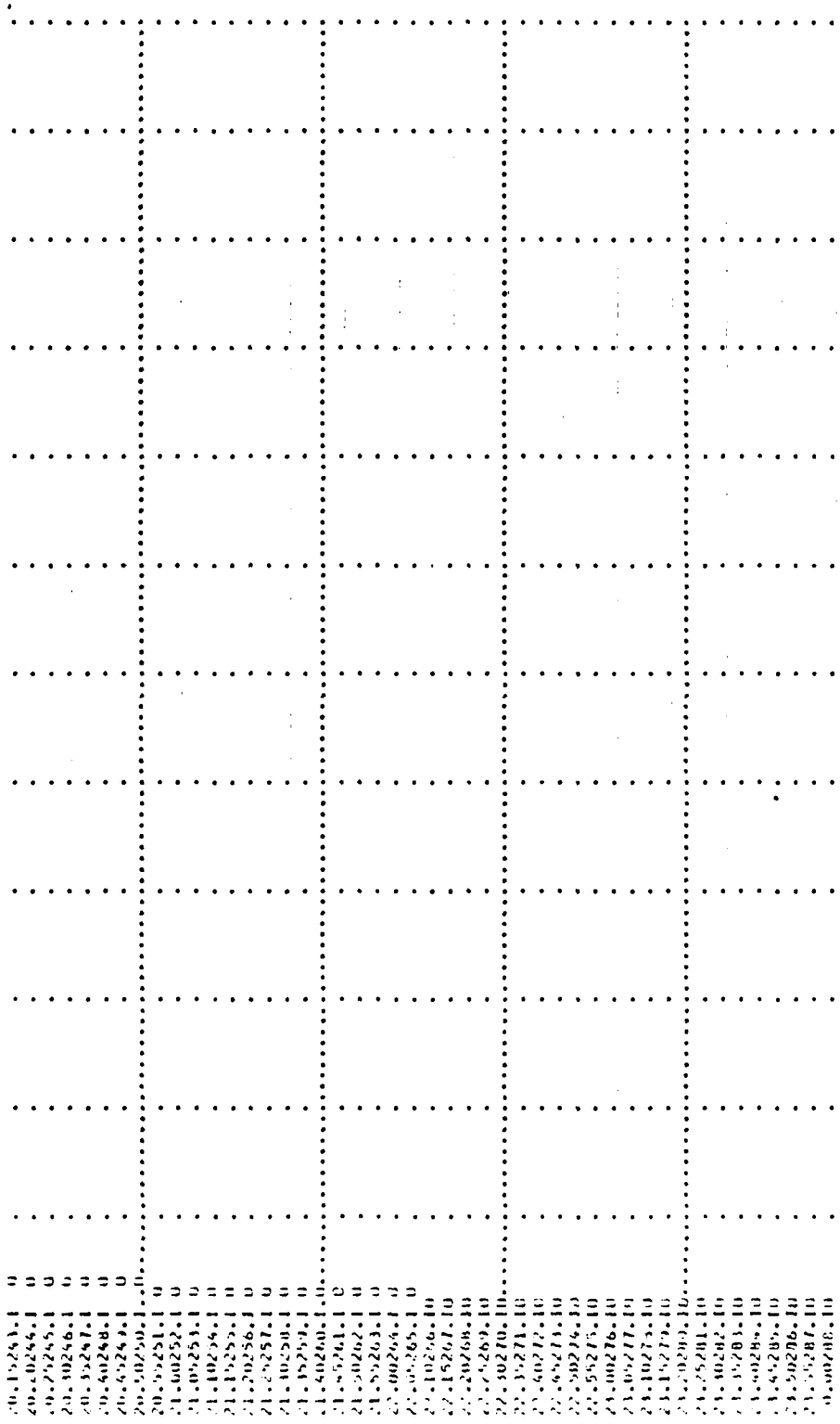


PLATE D-15

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

CONVERSION OF DIRECT RAINFALL ON RES 10366 TO CFS

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
CCCC03	0	0	0	2	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
-1	0	.21	0.00	.21	1.00	0.000	0	1	0

INPUT HYDROGRAPH - CFS

17.	17.	17.	17.	17.	17.	17.	17.	17.	17.
17.	17.	17.	17.	17.	17.	17.	17.	17.	17.
17.	17.	17.	17.	17.	17.	17.	17.	17.	17.
17.	17.	17.	17.	17.	17.	17.	17.	17.	17.
17.	17.	17.	17.	17.	17.	17.	17.	17.	17.
17.	17.	17.	17.	17.	17.	17.	17.	17.	17.
17.	17.	17.	17.	17.	17.	17.	17.	17.	17.
17.	17.	99.	99.	99.	99.	99.	99.	99.	99.
99.	99.	99.	99.	99.	99.	99.	99.	99.	99.
99.	99.	99.	99.	99.	99.	99.	99.	99.	99.
99.	99.	99.	99.	99.	99.	99.	99.	99.	99.
99.	99.	99.	99.	99.	99.	99.	99.	99.	99.
99.	99.	99.	99.	99.	99.	99.	99.	99.	99.
99.	99.	99.	99.	99.	99.	99.	99.	99.	99.
99.	99.	99.	99.	331.	331.	331.	331.	331.	331.
331.	331.	331.	331.	331.	331.	398.	398.	398.	398.
398.	398.	398.	398.	398.	398.	398.	398.	513.	513.
513.	513.	513.	513.	513.	513.	513.	513.	513.	513.
315.	613.	613.	928.	1077.	2617.	4307.	1689.	1077.	928.
613.	613.	480.	480.	480.	480.	480.	480.	480.	480.
480.	480.	480.	480.	364.	364.	364.	364.	364.	364.
364.	364.	364.	364.	364.	364.	33.	33.	33.	33.
33.	33.	33.	33.	33.	33.	33.	33.	33.	33.
33.	33.	33.	33.	33.	33.	33.	33.	33.	33.
33.	33.	33.	33.	33.	33.	33.	33.	33.	33.
33.	33.	33.	33.	33.	33.	33.	33.	33.	33.
33.	33.	33.	33.	33.	33.	33.	33.	33.	33.
33.	33.	33.	33.	33.	33.	33.	33.	33.	33.
33.	33.	33.	33.	33.	33.	33.	33.		

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4307.	560.	178.	178.	51140.
CMS	122.	16.	5.	5.	1448.
INCHES		24.33	30.87	30.87	30.87
MM		617.98	784.22	784.22	784.22
AC-FT		278.	352.	352.	352.
THOUS CU M		342.	434.	434.	434.

PLATE D-16

HYDROGRAPH AT STA0CC003 FOR PLAN 1, RTIO 6 0.5 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2153.	280.	89.	89.	25570.
CMS	61.	8.	3.	3.	724.
INCHES		12.17	15.44	15.44	15.44
MM		308.99	392.11	392.11	392.11
AC-FT		139.	176.	176.	176.
THOUS CU M		171.	217.	217.	217.

HYDROGRAPH AT STA000003 FOR PLAN 1, RTIO 7

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2799.	364.	115.	115.	33241.
CMS	79.	10.	3.	3.	941.
INCHES		15.81	20.07	20.07	20.07
MM		401.69	509.75	509.75	509.75
AC-FT		180.	229.	229.	229.
THOUS CU M		223.	282.	282.	282.

HYDROGRAPH AT STA0CC003 FOR PLAN 1, RTIO 8

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3445.	448.	142.	142.	40912.
CMS	98.	13.	4.	4.	1158.
INCHES		17.46	24.70	24.70	24.70
MM		494.39	627.38	627.38	627.38
AC-FT		222.	282.	282.	282.
THOUS CU M		274.	348.	348.	348.

HYDROGRAPH AT STA0C0003 FOR PLAN 1, RTIO 9 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4307.	560.	178.	178.	51140.
CMS	122.	16.	5.	5.	1448.
INCHES		24.33	30.87	30.87	30.87
MM		617.98	784.22	784.22	784.22
AC-FT		278.	352.	352.	352.
THOUS CU M		342.	434.	434.	434.

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COMBINE HYDROGRAPHS

INFLOW HYDRO ID RES 10366

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
M 2+3	2	0	0	2	0	1	0	0

SUM OF 2 HYDROGRAPHS AT M 2+3 PLAN 1 RTIO 1

PLATE D-17

SUM OF 2 HYDROGRAPHS AT M 2+3 PLAN 1 RTIO 9 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5082.	1932.	606.	606.	174532.
CMS	144.	55.	17.	17.	4942.
INCHES		16.13	20.24	20.24	20.24
MM		409.68	514.14	514.14	514.14
AC-FT		958.	1202.	1202.	1202.
THOUS CU M		1181.	1483.	1483.	1483.

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HYDROGRAPH ROUTING

ROUTED FLOWS THRU RES 10366

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
C00004	1	0	0	2	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-753.	-1

STAGE	753.40	754.00	754.30	754.60	755.10	756.10	757.00	758.00
FLOW	0.00	10.00	20.00	30.00	50.00	100.00	154.00	182.00

CAPACITY=	0.	147.	573.
ELEVATION=	753.	754.	758.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
753.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
756.8	2.9	1.5	4190.

CREST LENGTH AT OR BELOW	100.	470.	640.	1130.	1820.	2830.	3530.	4190.
ELEVATION	756.8	757.0	757.1	757.3	757.4	757.6	757.7	758.0

STATION C00004, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	2.	2.	2.	2.	2.	2.	2.	2.	2.

STATION 000004, PLAN 1, RATIO 9 PMF

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	2.	2.	2.	2.	2.	2.	2.
2.	2.	3.	3.	3.	3.	3.	3.	3.	3.
3.	4.	4.	4.	4.	4.	4.	4.	4.	5.
5.	5.	5.	5.	5.	5.	5.	6.	6.	6.
6.	6.	6.	6.	7.	7.	7.	7.	7.	7.
7.	7.	8.	8.	8.	8.	8.	8.	8.	8.
9.	9.	9.	9.	9.	9.	10.	10.	10.	10.
10.	11.	11.	11.	12.	12.	13.	14.	15.	16.
17.	17.	18.	19.	20.	21.	21.	22.	23.	24.
25.	26.	27.	28.	29.	30.	31.	33.	34.	35.
37.	38.	40.	41.	43.	44.	46.	47.	49.	50.
52.	53.	55.	58.	62.	68.	80.	90.	96.	101.
108.	118.	130.	150.	368.	1040.	2292.	3480.	4121.	4305.
4254.	4101.	3915.	3728.	3529.	3327.	3168.	3035.	2920.	2818.
2725.	2641.	2563.	2491.	2425.	2366.	2249.	2103.	1999.	1915.
1841.	1768.	1691.	1611.	1527.	1441.	1357.	1275.	1198.	1127.
1061.	1002.	949.	900.	856.	816.	779.	746.	717.	689.
664.	641.	619.	599.	580.	562.	545.	530.	515.	501.
487.	475.	463.	451.	440.	430.	420.	411.	402.	394.
386.	378.	371.	364.	358.	351.	345.	340.	334.	329.
324.	319.	315.	310.	306.	302.	298.	294.	291.	287.
284.	281.	278.	275.	272.	269.	266.	263.		

STORAGE

84.	84.	85.	85.	85.	85.	85.	85.	85.	85.
85.	86.	86.	86.	86.	86.	86.	86.	86.	86.
87.	87.	87.	87.	87.	87.	87.	87.	87.	88.
88.	88.	89.	88.	88.	88.	88.	89.	89.	89.
89.	89.	89.	89.	89.	89.	90.	90.	90.	90.
90.	90.	90.	90.	91.	91.	91.	91.	91.	91.
91.	91.	92.	92.	92.	92.	92.	92.	92.	92.
93.	93.	93.	94.	94.	95.	96.	97.	97.	98.
99.	99.	100.	101.	102.	102.	103.	104.	104.	105.
106.	107.	107.	108.	109.	110.	110.	111.	112.	113.
114.	114.	115.	116.	117.	117.	118.	119.	120.	121.
122.	122.	123.	124.	125.	126.	127.	127.	128.	129.
130.	131.	132.	133.	133.	134.	135.	136.	137.	138.
139.	140.	141.	142.	142.	143.	144.	145.	146.	147.
149.	149.	150.	151.	153.	155.	158.	160.	163.	166.
168.	171.	173.	176.	179.	181.	184.	187.	190.	193.
196.	199.	202.	206.	209.	212.	215.	218.	221.	225.
229.	233.	237.	241.	245.	249.	253.	257.	261.	265.
269.	273.	276.	282.	289.	302.	327.	369.	361.	372.
385.	402.	424.	451.	481.	511.	534.	548.	554.	556.
556.	554.	552.	551.	549.	546.	545.	543.	542.	541.
540.	539.	538.	537.	536.	535.	533.	531.	530.	528.
527.	526.	524.	523.	521.	520.	518.	516.	514.	513.
511.	509.	508.	506.	505.	504.	502.	501.	500.	499.

498.	497.	496.	495.	494.	493.	492.	491.	490.	490.
489.	488.	487.	487.	486.	485.	485.	484.	483.	483.
482.	482.	481.	481.	480.	480.	479.	479.	478.	478.
478.	477.	477.	476.	476.	476.	475.	475.	475.	474.
474.	474.	473.	473.	473.	472.	472.	472.		

STAGE

753.4	753.4	753.4	753.4	753.4	753.4	753.4	753.4	753.4	753.4
753.4	753.4	753.4	753.4	753.4	753.4	753.4	753.4	753.4	753.4
753.4	753.4	753.4	753.4	753.4	753.4	753.4	753.4	753.4	753.4
753.4	753.4	753.4	753.4	753.4	753.4	753.4	753.4	753.4	753.4
753.4	753.4	753.4	753.4	753.4	753.4	753.5	753.5	753.5	753.5
753.5	753.5	753.5	753.5	753.5	753.5	753.5	753.5	753.5	753.5
753.5	753.5	753.5	753.5	753.5	753.5	753.5	753.5	753.5	753.5
753.5	753.5	753.5	753.5	753.5	753.5	753.5	753.5	753.5	753.5
753.5	753.5	753.6	753.6	753.6	753.6	753.6	753.6	753.6	753.6
753.6	753.6	753.6	753.6	753.6	753.6	753.6	753.7	753.7	753.7
753.7	753.7	753.7	753.7	753.7	753.7	753.7	753.7	753.7	753.7
753.8	753.8	753.8	753.8	753.8	753.8	753.8	753.8	753.8	753.8
753.8	753.8	753.9	753.9	753.9	753.9	753.9	753.9	753.9	753.9
753.9	753.9	753.9	753.9	754.0	754.0	754.0	754.0	754.0	754.0
754.0	754.0	754.0	754.0	754.1	754.1	754.1	754.1	754.1	754.2
754.2	754.2	754.2	754.3	754.3	754.3	754.3	754.4	754.4	754.4
754.5	754.5	754.5	754.5	754.6	754.6	754.6	754.7	754.7	754.7
754.8	754.8	754.8	754.9	754.9	755.0	755.0	755.0	755.1	755.1
755.1	755.2	755.2	755.3	755.3	755.5	755.7	755.9	756.0	756.1
756.2	756.4	756.6	756.9	757.1	757.4	757.6	757.8	757.8	757.8
757.8	757.8	757.8	757.8	757.8	757.8	757.7	757.7	757.7	757.7
757.7	757.7	757.7	757.7	757.7	757.6	757.6	757.6	757.6	757.6
757.6	757.6	757.5	757.5	757.5	757.5	757.5	757.5	757.5	757.4
757.4	757.4	757.4	757.4	757.4	757.4	757.3	757.3	757.3	757.3
757.3	757.3	757.3	757.3	757.3	757.2	757.2	757.2	757.2	757.2
757.2	757.2	757.2	757.2	757.2	757.2	757.2	757.2	757.2	757.2
757.2	757.1	757.1	757.1	757.1	757.1	757.1	757.1	757.1	757.1
757.1	757.1	757.1	757.1	757.1	757.1	757.1	757.1	757.1	757.1
757.1	757.1	757.1	757.1	757.1	757.1	757.1	757.1		

PEAK OUTFLOW IS 4305. AT TIME 16.67 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4305.	1522.	412.	412.	118719.
CMS	122.	43.	12.	12.	3362.
INCHES		12.71	13.77	13.77	13.77
MM		322.73	349.72	349.72	349.72
AC-FT		755.	818.	818.	818.
THOUS CU M		931.	1009.	1009.	1009.

PLATE D-21

DVF

STATIONC00004

(INFLOW(I), OUTFLOW(O) AND OBSERVED FLOW(*)

	0.	1000.	2000.	3000.	4000.	5000.	6000.	0.	0.	0.	0.	0.	0.
.05	11												
.10	21												
.15	31												
.20	41												
.25	51												
.30	61												
.35	71												
.40	81												
.45	91												
.50	101												
.55	111												
1.00	121												
1.05	131												
1.10	141												
1.15	151												
1.20	161												
1.25	171												
1.30	181												
1.35	191												
1.40	201												
1.45	211												
1.50	221												
1.55	231												
2.00	241												
2.05	251												
2.10	261												
2.15	271												
2.20	281												
2.25	291												
2.30	301												
2.35	311												
2.40	321												
2.45	331												
2.50	341												
2.55	351												
3.00	361												
3.05	371												
3.10	381												
3.15	391												
3.20	401												
3.25	411												
3.30	421												
3.35	431												
3.40	441												
3.45	451												
3.50	461												
3.55	471												
4.00	481												
4.05	491												
4.10	501												
4.15	511												
4.20	521												
4.25	531												
4.30	541												
4.35	551												
4.40	561												

PLATE D-22

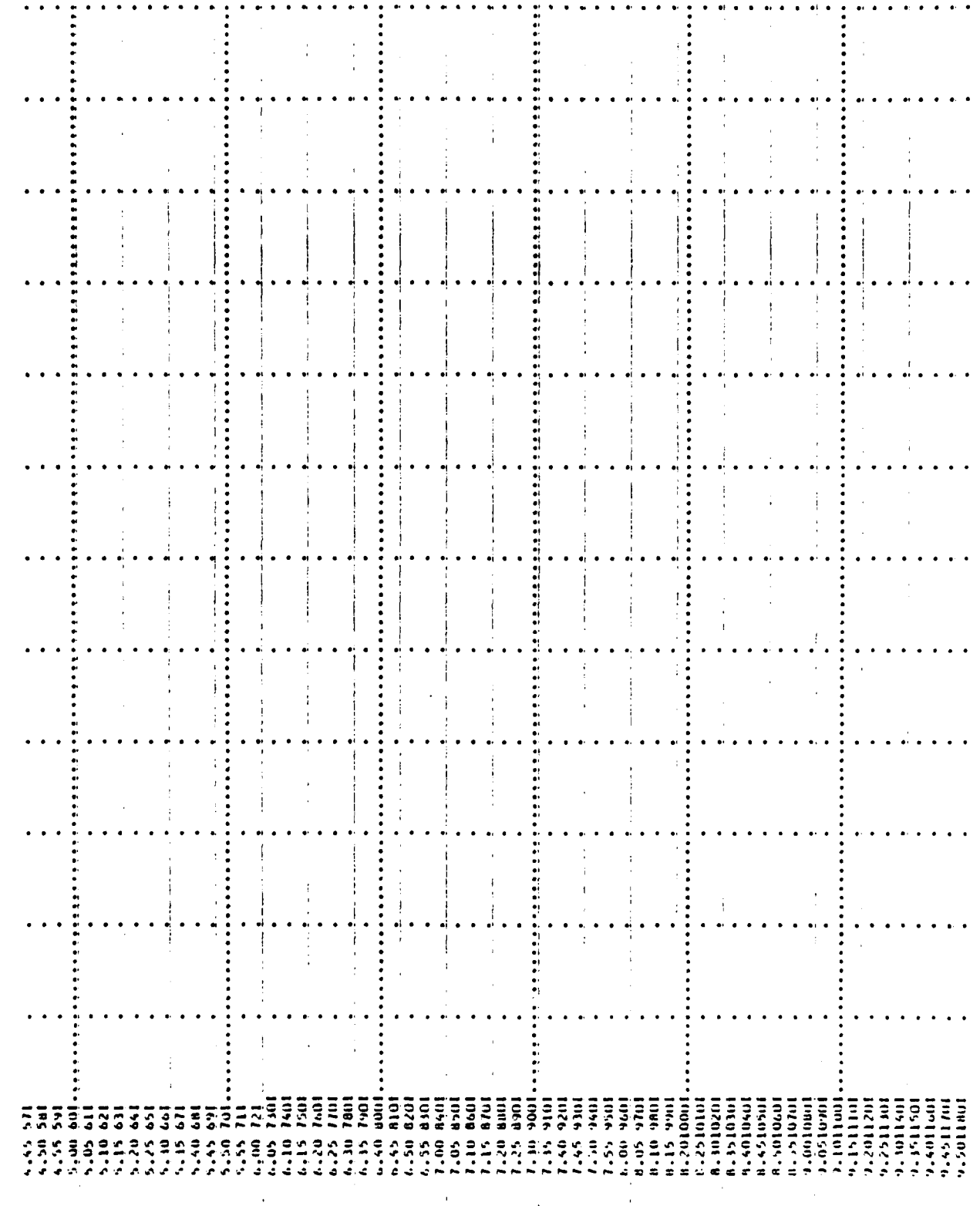

PLATE D-23

PLATE D-24

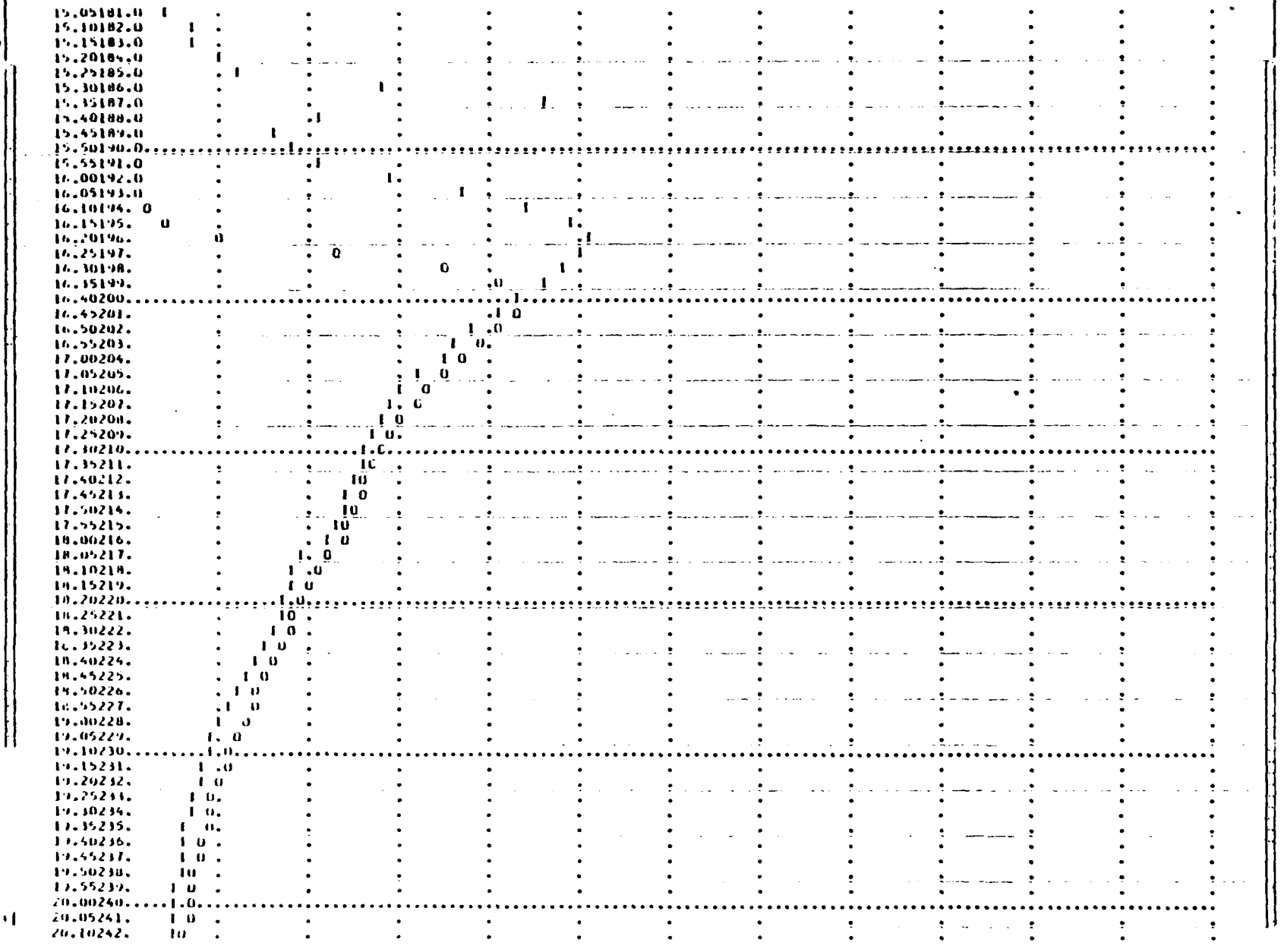

PLATE D-25

PLATE D-26

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .05	RATIO 2 .10	RATIO 3 .15	RATIO 4 .20	RATIO 5 .35	RATIO 6 .50	RATIO 7 .65	RATIO 8 .80	RATIO 9 1.00
HYDROGRAPH AT	000001	.90	1	322.	645.	967.	1289.	2256.	3223.	4190.	5157.	6446.
		2.33		9.13	18.25	27.38	36.51	63.89	91.27	118.65	146.03	182.54
ROUTED TO	000002	.90	1	16.	32.	52.	67.	98.	127.	1128.	2294.	4602.
		2.33		.44	.91	1.48	1.91	2.76	9.25	31.95	64.95	130.31
HYDROGRAPH AT	000003	.21	1	215.	431.	646.	961.	1507.	2153.	2799.	3445.	4307.
		.55		6.10	12.19	18.29	24.39	42.68	60.97	79.27	97.56	121.95
2 COMBINED	M-43	1.11	1	223.	446.	669.	892.	1566.	2230.	2890.	3548.	5082.
		2.89		6.31	12.62	18.95	25.27	44.35	63.15	81.82	100.46	143.91
ROUTED TO	000004	1.11	1	4.	9.	16.	24.	47.	91.	553.	1974.	4305.
		2.89		.12	.24	.45	.68	1.33	2.58	15.65	55.89	121.89

PLATE D-27

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .RES..10365

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	784.00	784.00	791.00
STORAGE	689.	689.	1240.
OUTFLOW	0.	0.	109.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.05	784.91	0.00	753.	16.	0.00	19.00	0.00
.10	785.95	0.00	817.	32.	0.00	19.00	0.00
.15	786.81	0.00	881.	52.	0.00	18.92	0.00
.20	787.65	0.00	944.	67.	0.00	18.92	0.00
.35	789.88	0.00	1140.	98.	0.00	19.08	0.00
.50	791.90	.90	1321.	327.	7.00	18.67	0.00
.65	792.61	1.61	1395.	1128.	7.92	17.67	0.00
.80	793.07	2.07	1443.	2294.	8.25	16.67	0.00
1.00	793.62	2.62	1500.	4602.	8.83	16.33	0.00

PLATE D-28

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 RES.10366

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	753.40	753.40	756.80
STORAGE	84.	84.	445.
OUTFLOW	0.	0.	142.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.05	753.65	0.00	111.	4.	0.00	24.00	0.00
.10	753.91	0.00	138.	9.	0.00	24.00	0.00
.15	754.18	0.00	167.	16.	0.00	24.00	0.00
.20	754.42	0.00	192.	24.	0.00	24.00	0.00
.35	755.03	0.00	257.	47.	0.00	24.00	0.00
.50	755.92	0.00	352.	91.	0.00	24.00	0.00
.65	757.23	.43	492.	553.	5.83	19.42	0.00
.80	757.59	.79	529.	1974.	7.25	17.75	0.00
1.00	757.85	1.05	556.	4305.	7.92	16.67	0.00

PLATE D-29